SMITHSONIAN INSTITUTION LIBRARIES

SMITHSONIAN INSTITUTION LIBRARIES

RARIES
INSTITU
LIBRARIES SMITHSONIAN INSTITUTION
RARIES
INSTITU
RARIES
INSTITU
RARIES
INSTITU
RARIES

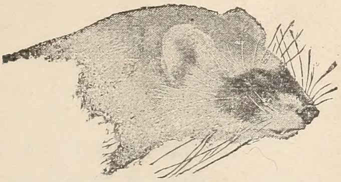
5 mam.
Old Cover
15
/
12614
Smith
48

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 10

[Actual date of publication, December 31, 1895]



Revision of the Shrews of the American Genera Blarina and Notiosorex
C. HART MERRIAM
The Long-tailed Shrews of the Eastern United States
GERRIT S. MILLER, Jr.
Synopsis of the American Shrews of the Genus Sorex
C. HART MERRIAM

SMITHSONIAN INSTITUTION
273121
U. S. NATIONAL MUSEUM.

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1895

591.97
.U58
2d set
§ Mam.

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Washington, D. C., August 31, 1895.

Sir: I have the honor to transmit herewith, for publication as No. 10 of North American Fauna, three papers on North American Shrews, embracing results of investigations made by the Division of Ornithology and Mammalogy.

Respectfully,

C. Hart Merriam,
Chief of Division of Ornithology and Mammalogy.

Hon. J. Sterling Morton,
Secretary of Agriculture.

CONTENTS.

	Page.
Revision of the Shrews of the American genera *Blarina* and *Notiosorex*. By C. Hart Merriam	5
The Long-tailed Shrews of the Eastern United States. By Gerrit S. Miller, jr.	35
Revision of the American Shrews of the genus *Sorex*. By C. Hart Merriam	57
Addendum	98

ILLUSTRATIONS.

PLATES.

1. Skulls of *Blarina carolinensis, brevicauda, parva, floridana, tropicalis, soricina, magna,* and *mexicana.*
2. Jaws and teeth (enlarged) of *Blarina brevicauda* and *telmalestes.*
3. Jaws and teeth (enlarged) of *Blarina carolinensis, parva,* and *berlandieri* and *Notiosorex crawfordi.*
4. Jaws and teeth (enlarged) of *Sorex personatus,* and *longirostris.*
5. Jaws and teeth (enlarged) of *Sorex palustris, albibarbis, araneus, richardsoni, fumeus.* and *hoyi.*
6. Skulls of *Sorex palustris, albibarbis, araneus, richardsoni, fumeus, minutus, personatus, longirostris,* and *hoyi.*
7. Jaws and teeth (enlarged) of *Sorex pacificus, macrodon, bairdi, trowbridgii,* and *personatus.*
8. Jaws and teeth (enlarged) of *Sorex dobsoni, vagrans, ornatus, oreopolus,* and *S. tenellus nanus.*
9. Jaws and teeth (enlarged) of *Sorex richardsoni, fumeus, pribilofensis, merriami, hoyi, longirostris, personatus,* and *dobsoni.*
10. Jaws and teeth (enlarged) of *Sorex* (*Atophyrax*) *bendirii* and *Sorex* (*Neosorex*) *palustris.*
11. Jaws and teeth (enlarged) of *Sorex* (*Neosorex*) *navigator,* showing changes resulting from wear.
12. Skulls of *Sorex* (*Atophyrax*) *bendirii palmeri, Sorex* (*Microsorex*) *hoyi, Sorex californicus, tenellus, merriami,* and *macrodon.*

No. 10. NORTH AMERICAN FAUNA. December, 1895.

REVISION OF THE SHREWS OF THE AMERICAN GENERA BLARINA AND NOTIOSOREX.

By C. Hart Merriam.

The Short-tailed Shrews of America belong to two genera—*Blarina* and *Notiosorex*. Of the former, 14 alleged species have been described; of the latter, only 2. Respecting the status and geographic ranges of these species much confusion exists. In order to obtain authentic information on these points the Department has made a special effort to secure large series of specimens, and has sent trained collectors to most of the original type localities of the forms that have been named. Moreover, one of the field naturalists of the Division of Ornithology and Mammalogy, Mr. E. W. Nelson, while conducting biological explorations in Mexico, has obtained a number of new species. As a result, upward of 600 specimens of the United States species and more than 200 of the Mexican species are now before me.[1] Either the original types, or duplicate types obtained from the original type localities, of all the United States and Mexican species have been examined. The conclusions derived from a study of this material are embodied in the present paper.

Genus BLARINA Gray, 1838.

Dental formula.—$i, \frac{4 \text{ or } 3}{2}; \; c, \frac{1}{0}; \; pm \frac{2}{1}; m, \frac{3}{3} = \frac{9 \text{ or } 10}{6} \times, 2 = \frac{18 \text{ or } 20}{12} =$ 30 or 32.

Teeth, 32 or 30; unicuspids, 5 or 4. First and second unicuspids large and subequal or second largest; third and fourth much smaller; fifth minute or absent; unicuspids (except minute posterior one) broad and bearing a secondary cusplet on inner side; all the teeth heavily tipped with dark chestnut, which usually reaches far down on the crowns. Cranium rather high and usually angular. No apparent external ears; tail short, always less than half the length of head and body; legs short; body usually stout and thickset (but more slender in the *parva* group).

HISTORY AND NOMENCLATURE.

For a long time the Short-tailed Shrews were included in the genus *Sorex*. They were first separated by Gray in 1838 under the name *Blarina*, proposed as a subgenus.[2] Four years later (1842) *Blarina* was raised to full generic rank by Lesson.[3]

---

[1] In addition to the specimens in the Department collection and my private collection, I have had the privilege of examining about 100 belonging to Mr. Gerrit S. Miller, jr.

[2] Proc. Zool. Soc. London, 1837 (June, 1838), 124.

[3] Lesson, Nouv. Tableau Mammif., 1842, 89.

Baird in 1857 divided the genus *Blarina* in two sections, according to the number of teeth; and Coues in 1877 recognized and named these sections as subgenera: *Blarina* proper, with 32 teeth, and *Soriciscus*, with 30. The reduction is in the unicuspids, of which there are 5 in *Blarina* proper, as in true *Sorex*, and only 4 in *Soriciscus*.[1] The lost tooth in the latter subgenus is the second premolar. So far as the United States species go, the two groups are well defined, the first comprising the larger species with massive, angular skulls, the second the smaller species with relatively light, *Sorex*-like skulls. But in the Mexican species these distinctions fail, the larger species having large, angular skulls, closely resembling that of the northern *Blarina brevicauda.*

The first Short-tailed Shrews known to have fallen under the eye of a naturalist were two specimens secured by Mr. Say, naturalist of Major Long's expedition to the Rocky Mountains, at Engineer Cantonment in eastern Nebraska, a few miles north of the present site of Omaha. It is a singular coincidence that these two specimens became the types of the largest and smallest species of the genus *Blarina* and later, of the two subgenera into which the genus was split. They were collected during the winter of 1819–20, and were described by Mr. Say in 1823, the larger as *Sorex brevicaudus*, the smaller as *Sorex parvus*.[2] It would have been far better if no others had been described from the United States, for excepting the *S. carolinensis* of Bachman all the other names since proposed fall as synonyms under one or the other of Say's species.

Specimens of the larger species (*brevicauda*) from near Lake Simcoe, Ontario, were described by Gapper in 1830, under the name *Sorex talpoides*,[3] which name has been used by some writers in the same sense as *brevicauda*. Other specimens, from New Jersey, were described by Bachman in 1837, under the name *Sorex dekayi*.[4] The same year (1837) Bachman described as new two additional species, *carolinensis* and *cinereus*,[5] both from South Carolina. The latter is a very small animal and proves to be the same as *S. parvus* of Say. This was suspected by Bachman himself and also by Baird. Bachman's *carolinensis* is a well-defined form, intermediate in size between *brevicauda* and *parva*, and restricted to the Austroriparian zone.

In 1857 Baird recognized *brevicauda* of Say, *talpoides* of Gapper, *carolinensis* and *cinereus* of Bachman, and added three others, which he named *angusticeps*, *exilipes*, and *berlandieri*.[6] *B. angusticeps* (from Burlington, Vt.) is an abnormal individual of *brevicauda* (skull small and deformed); *B. exilipes* (from Washington, Miss.) seems to be identical with *B. parva;* while *B. berlandieri* (from Matamoras, Mexico) is either a distinct species or a subspecies of *parva.*

---

[1] But *Soriciscus* is antedated by *Cryptotis* Pomel (1848), which was based on the same type species (*cinerea* Bach. = *parva* Say).

[2] Say, in Long's Exped. to the Rocky Mts., I, 1823, 164.

[3] Gapper, Zool. Jour., V, 1830, 202, Pl. VIII.

[4] Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, 1837, 377–381.

[5] Ibid, pp. 366–370 and 373–376.

[6] Baird, Mammals N. Am., 1857, 47–48, 51–54.

The status and relationships of *Blarina parva* have never been correctly understood. As stated above the species was described by Say more than seventy years ago from a specimen from eastern Nebraska. In 1837 Bachman described a Shrew from South Carolina under the name *Sorex cinereus.* He had great difficulty in separating it from Say's *S. parvus*, and "felt at one time a strong inclination to set it down as that animal."[1] In 1857 Baird admitted *S. cinereus*, and correctly transferred it from *Sorex* to *Blarina.* But he took pains to state that he was unfamiliar with *Sorex parvus* of Say. Like Bachman, he suspected the identity of the two, for he says that *parva* "comes very close to the *Sorex cinereus* of Bachman, and may possibly some day supplant its name."[2] In the same year (1857) Baird added another supposed species, which he called *Blarina exilipes.*[3] The type specimens came from Washington, Miss.; and specimens from Spottsylvania County, Va., Brownsville, Tenn. [Texas?], St. Louis, Mo., and Dekalb County, Ill., were referred to the same species though those from the two latter localities were provisionally separated under the name *eximius*, afterward adopted by Kennicott.[4]

After careful comparison of specimens from the type localities of *parva*, *cinerea*, and *exilipes*, I am unable to detect any characters by which any one of them may be distinguished from the others. Baird himself was by no means positive of their distinctness. His remarks about *B. cinerea* have just been quoted; of *B. exilipes* he said: "I can not feel sure that the Mississippi specimens may not prove to be the young of *S. cinereus.*"[5]

In 1861 Tomes described a small species from Coban, Guatemala, and named it *Sorex micrurus.*[6] This is the only member of the genus known from any point south of Mexico.

In 1877 Coues published an additional species, from Jalapa, Mexico, under the name *Blarina* (*Soriciscus*) *mexicana* (Baird MS).[7]

In 1891 Allen described a large *Blarina* which he named *B. costaricensis*[8] because the type and only specimen was supposed to have been taken in Costa Rica; but it really came from the Upper Mississippi Valley and is a typical *brevicauda.*[9]

---

[1] Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, 1837, p. 375.

[2] Baird, Mammals N. Am., 1857, pp. 50, 56.

[3] Ibid, pp. 51–53.

[4] Ibid, p. 52; Quadrupeds of Illinois, 1858, p. 97.

[5] Ibid., p. 52.

[6] Tomes, Proc. Zool. Soc. London, 1861, 279. The name *micrura* is preoccupied and *tropicalis* is here substituted for it. (See p. 23, foot note.)

[7] Coues, Bull. U. S. Geol. and Geog. Surv., III, May 15, 1877, 652, 653

[8] Allen, Bull. Am. Mus. Nat. Hist., III, No. 2, April, 1891, 205, 206.

[9] See *postea*, under *Blarina brevicauda*, p. 14.

In 1895 Allen described two small species from Costa Rica: *Blarina* (*Soriciscus*) *nigrescens*, and *Blarina* (*Soriciscus*) *orophila.*

Thus up to the present time 8 valid species have been described, 3 from the United States (*brevicauda*, *carolinensis*, and *parva*), 2 from Mexico (*berlandieri* and *mexicana*), 1 from Guatemala (*micrura* = *tropicalis*) and 2 from Costa Rica. Twelve new forms are here added (1 from Dismal Swamp, Virginia, 2 from Florida, and 9 from Mexico), making 20 members of the genus now known. These, with their type localities, are as follows:

LIST OF SPECIES AND SUBSPECIES OF BLARINA.

Subgenus *Blarina:*	
Blarina brevicauda (Say)	Blair, Nebraska.
carolinensis (Bach.)	Eastern South Carolina.
carolinensis peninsulæ nov.	Miami, Florida.
telmalestes sp. nov	Dismal Swamp, Virginia.
Subgenus *Cryptotis:*	
Blarina parva (Say)	Blair, Nebraska.
floridana sp. nov	Canaveral, Florida.
berlandieri Baird	Matamoras, Mexico.
tropicalis nom. nov	Coban, Guatemala.
soricina sp. nov	Tlalpam, Valley of Mexico.
obscura sp. nov	Tulancingo, Hidalgo, Mexico.
mexicana Baird	Jalapa, Vera Cruz, Mexico.
mexicana goldmani subsp. nov.	Mts. near Chilpancingo, Guerrero, Mexico.
mexicana peregrina subsp. nov.	Mountains near Oaxaca, Oaxaca, Mexico.
mexicana machetes subsp. nov.	Mountains near Ozolotepec, Oaxaca, Mex.
nelsoni sp. nov	Volcano of Tuxtla, Vera Cruz, Mexico.
fossor sp. nov	Mount Zempoaltepec, Oaxaca, Mexico.
alticola sp. nov	Mount Popocatapetl, Mexico.
magna sp. nov	Totontepec, Oaxaca, Mexico.
nigrescens Allen	San Isidro, San José, Costa Rica.
orophila Allen	Volcano of Irazu, Costa Rica.

Geographic distribution.—The genus *Blarina* is confined to North America, where it ranges from the mountains of Central America northward to the southern border of the Boreal zone in Canada. It attains its highest development in the mountains of southern Mexico—the same region in which the family *Geomyidæ* is represented by so large a number of species and genera.[1] Although several of the species now inhabit the boreal summits of mountains, and one is restricted to the Tropical belt, the genus as a whole is clearly of Austral origin. In the course of time, groups having their centers of distribution in particular areas or zones often overflow into adjacent zones, and it is not unusual for tropical and austral types in the neighborhood of high mountains to push up the slopes of these mountains and become acclimated. Such forms commonly undergo a degree of modification sufficient to admit of their ready recognition as distinct species or subspecies. Thus *Blarina soricina*, from an altitude of 7,600 feet in the

---

[1] See Monograph of the Geomyidæ, N. Am. Fauna, No. 8, Jan., 1895.

Valley of Mexico, while not strictly a mountain form, is clearly an offshoot from the tropical *B. tropicalis.*

In the United States the only species that passes beyond the Austral region is *brevicauda.* It penetrates the southern edge of the Boreal zone along the northern limit of its range, and ascends the higher mountains of North Carolina and Tennessee to the same zone.

In southern Mexico some of the high mountains have been so long isolated that the species of *Blarina* inhabiting them have become differentiated into local races or representative species. Thus the colonies of the widely diffused *B. mexicana* type inhabiting mountains near Oaxaca, Ozolotepec, and Chilpancingo, have developed peculiarities by which each may be recognized from the others and also from the typical form from Vera Cruz. Similarly *B. alticola*, of Mount Popocatapetl and other high mountains about the Valley of Mexico, is represented on Mount Zempoaltepec, Oaxaca, by a closely allied species, *B. fossor.*

NUMBER OF SPECIMENS OF EACH SPECIES EXAMINED.

Subgenus *Blarina:*	
Blarina brevicauda	436
carolinensis	89
peninsulæ	7
telmalestes	1
Subgenus *Cryptotis:*	
Blarina parva	114
floridana	4
berlandieri	8
tropicalis	25
soricina	3
obscura	2
Subgenus *Cryptotis*—Continued.	
Blarina mexicana	110
goldmani	5
peregrina	25
machetes	7
nelsoni	11
alticola	10
fossor	5
magna	2
nigrescens	1
orophila	1

Subgenus BLARINA Gray.

1838. *Blarina* (subgenus of *Sorex*) Gray, Proc. Zool. Soc. London 1837 (June, 1838), 124. Type, *Sorex talpoides* Gapper = *S. brevicaudus* Say.
1842. *Blarina* (full genus) Lesson, Nouv. Tableau Mammif., 1842, 89.
1842. *Brachysorex* (subgenus) Duvernoy, Mag. de Zool., 2d ser., IV, 1842, 37–41. Type, *Sorex brevicauda* Say. (Specimen from New Harmony, Ind., and somewhat intermediate between *brevicauda* and *carolinensis.*)
1843. *Blaria* Gray, List of Spec. Mammalia British Mus., 1843, XXI; List of Osteol. Spec. British Mus., 1847, XI, 23.
1848. *Talposorex* Pomel, Archiv. Sci. Phys. and Nat. Genève, IX, 1848, 248. (Type, *Sorex carolinensis* Dekay = *S. brevicaudus* Say.) Not *Talpasorex* Lesson, 1827.
1848. *Galemys* Pomel, Ibid., IX, 1848, 249 (in part; includes also *Crossopus* and *Pachyura*); not *Galemys* Kaup, 1829.
1855. *Anotus* (subgenus) Wagner, Suppl. Schreber's Säugthiere, V, 1855, 550–551. Type, *Sorex carolinensis* Bach., from South Carolina.

Diagnosis.—Teeth, 32; unicuspids, 5, the anterior 4 in two pairs; first and second largest and subequal; third and fourth abruptly much smaller and subequal; fifth minute (see fig. 1, *a* and *b*, p. 10). Basal lobe of middle incisor elongated anteroposteriorly. Brain case not arched anteroposteriorly, highest at lambdoid suture; plane of occiput nearly flat.

Geographic distribution.—Broadly, the Austral region of the eastern half of the United States. One species (*B. brevicauda*) reaches the southern edge of the Boreal in southern Canada and the mountains farther south; another (*B. peninsulæ*) inhabits peninsular Florida.

Number of representatives.—Only 4 members of the subgenus *Blarina* are here recognized—the large *B. brevicauda* and *telmalestes*, and the smaller *carolinensis* and *peninsulæ*. Several slightly characterized local forms of *brevicauda* might be defined, but are not deemed worthy of recognition by name. *B. brevicauda* intergrades with *carolinensis*, and *carolinensis* with *peninsulæ*, leaving *telmalestes* as the only completely isolated form now known.

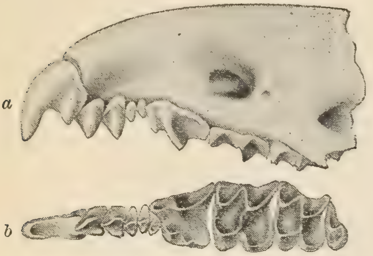


FIG. 1.—Upper series of teeth of *Blarina carolinensis*. *a*. Outer side; *b*. Crowns.

KEY TO SPECIES AND SUBSPECIES.

Size largest (total length about 120 mm. or more); brain case and under jaw strongly ngular.
  Postero-internal lobe of molars narrow and elliptical................ *brevicauda*
  Postero-internal lobe of molars broad and rounded..................... *telmalestes*
Size smaller (length less than 100 mm.); brain case and under jaw less angular.
  Color dull plumbeous washed with brownish (hind foot about 12 mm.).. *carolinensis*
  Color slate black (hind foot more than 13 mm.)........................... *peninsulæ*

BLARINA BREVICAUDA (Say). Large Blarina.

Pl. 1, figs. 2–4; Pl. 2, figs. 1–4.

ORIGINAL REFERENCES.

1823. *Sorex brevicaudus* Say in Long's Exped. to the Rocky Mts., I, 1823, 164. (From near Blair, Nebr.)
1830. *Sorex talpoides* Gapper, Zool. Jour., V, 1830, 202, Pl. VIII. (From vicinity of Lake Simcoe, Ontario, Canada.)
1837. *Sorex dekayi* (Cooper) Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, 1837, 377–381. (From New Jersey.)
1857. *Blarina angusticeps* Baird, Mammals N. Am., 1857, 47–48. (Deformed skull from Burlington, Vt.).
1891. *Blarina costaricensis* Allen, Bull. Am. Mus. Nat. Hist. New York, III, 1891, 205–206. (Supposed to be from Costa Rica, but really from the Upper Mississippi Valley. See *postea*, p. 12.)

SECONDARY REFERENCES.

Sorex brevicaudus Bach., Jour. Acad. Nat. Sci. Phila., VII, Part II, 1837, 3; Aud. and Bach., Quadrupeds N. Am., III, 1854, 335–336.
Corsira (*Blarina*) *talpoides* Gray, Proc. Zool. Soc. London, 1837 (June, 1838), 124 [= *Sorex talpoides* Gapper = *S. brevicaudus* Say].
Blarina brevicaudata Lesson, Nouv. Tableau Mammif., 1842, 89.
Galemys (*Brachysorex*) *micrurus* Pomel, Archiv. Sci. Phys. et Nat.. Genève, 1848, 249.
Blarina brevicauda Baird, Mammals N. Am., 1857, 42–45; Merriam, Mammals Adirondacks, 1884, 164–173 (habits).

Type locality.—West bank of Missouri River, near Blair, Nebr. (formerly Engineer Cantonment, 3 miles above mouth of Boyer River).

Geographic distribution.—Upper Austral and Transition zones, from western Nebraska and Manitoba eastward to the Atlantic Coast, penetrating a short distance into lower edge of boreal.

Habitat.—Chiefly deciduous woodlands and fields, where it lives in shallow tunnels that are often marked on the surface by little ridges.

General characters.—Size largest of the subgenus (total length about 125 mm.); skull largest and heaviest of the American *Soricidæ;* pelage glossy.

Color.—Sooty-plumbeous above, becoming ashy-plumbeous below, varying with the light; paler in summer; glossy in fresh pelage.

Cranial characters.—Skull large, massive, and angular (averaging 23 to 25 mm. in greatest length, and about 13 mm. in greatest breadth); occipital plane relatively large, nearly flat, and sloping strongly forward (not arched). The brain case presents the maximum of angularity known in the group, and is highest at the lambdoid suture. The ramus of the jaw is angular, being bent rather abruptly upward opposite the last molar. The upper lateral incisors contrasted with those of *carolinensis* are relatively narrower at base and slope more strongly forward; the first upper premolar (5th unicuspid) is usually visible from the outside.

Measurements.—Average of 8 specimens from near type locality: Total length, 127 mm.; tail vertebræ, 26.5 mm.; hind foot, 16.5 mm. Average of 31 specimens from Lake George, New York: Total length, 122 mm.; tail vertebræ, 26.5 mm.; hind foot, 15 mm. Average of 6 specimens from Marthas Vineyard, Massachusetts: Total length, 115 mm.; tail vertebræ, 22 mm.; hind foot, 13.4 mm.

General remarks.—*Blarina brevicauda* presents considerable variation in size and tint of color. The largest specimens are from western Nebraska, and those from eastern Nebraska (type locality) are larger than specimens from the Northern and Eastern States. From the type locality as a center, decrease in size takes place to the north, east, and south. Specimens from both sides of the Canadian boundary, between Manitoba and Lake Superior, are decidedly smaller than those from Nebraska, Iowa, and southern Minnesota, but larger than those from the Atlantic States. The smallest specimens I have seen are from eastern Massachusetts. Through the courtesy of Mr. Gerrit S. Miller, jr., I have been able to examine a number of skulls in his private collection from the following localities near the coast of that State: West Dedham, Wareham, Provincetown, Seekonk, Marthas Vineyard, and Nantucket. These skulls agree closely among themselves and average 22 mm. in greatest length (including incisors) and 12 mm. in breadth. Specimens from Nova Scotia, Ontario, New Hampshire, and Maine are larger, agreeing with those from the Adirondacks. The latter, however, are decidedly smaller than typical *brevicauda* from the Upper Mississippi Valley. This intermediate form was named *Sorex talpoides* by Gapper in 1830 (type from near Lake Simcoe, Ontario, Canada), and has been recognized as a distinct species by Baird (1857) and Miller (1893).[1] The impossibility of assigning logical geographic ranges to the resulting two forms, since the smaller *talpoides* surrounds the larger *brevicauda* on three sides (north, east, and south), and the additional fact that *talpoides* is intermediate between the large Nebraska *brevicauda* and the small form from the coast of New England are material obstacles to the recognition of *talpoides*, even as a subspecies. Furthermore, the species as a whole grades into *carolinensis* when it approaches the edge of the Austroriparian fauna; hence *talpoides*, being in this sense only an intergrade between *brevicauda* and *carolinensis*, is unworthy of recognition by name.

In color eastern specimens average slightly paler than those from the Mississippi Valley, but the seasonal difference is as great as the geographic. There is also much difference in the apparent color of the same specimen, according to the way it is held with reference to the light. A skin that is dusky or sooty when held away from the light and viewed from behind becomes almost ashy gray when looked at from the opposite direction. Winter specimens from Elk River, Minn., sometimes have a well-marked brownish-chestnut dorsal band.

Note on the so-called Blarina costaricensis.—Dr. J. A. Allen has kindly loaned me the type specimen of his *Blarina costaricensis.* It is in every respect a typical *Blarina brevicauda*, and doubtless came from some point in the Upper Mississippi Valley, probably Iowa. The skull and teeth agree perfectly with specimens from this State, where the collector, Mr. Cherrie, lived before he went to Costa Rica. The specimen had no label when it reached Dr. Allen. I do not doubt Mr. Cherrie's entire sincerity in thinking that it came from Costa Rica, but, as too well known, unlabeled museum specimens—particularly alcoholics—often have a way of becoming hopelessly mixed. Dr. Allen states that the skull received from Mr. Cherrie is larger than that of *B. talpoides* and the dentition heavier. These are precisely the ways in which true *brevicauda* from Iowa and Nebraska differs from its smaller representative of the Atlantic States, which has been called *talpoides.* I have just compared the skull of the type specimen of *costaricensis* with skulls from the type locality of *brevicauda* and find that the latter is somewhat larger and has equally heavy or slightly heavier teeth.

In clearing up the status of *costaricensis* an awkward geographical difficulty is also overcome, for the subgenus *Blarina* (with 32 teeth) is absolutely restricted to the United States. All of the specimens examined from Mexico and Guatemala, more than 200 in number, belong to the subgenus *Cryptotis* (with 30 teeth). It surpasses belief that a colony of the northern *Blarina brevicauda* should exist in the tropics of Costa Rica, separated from the normal range of its species by a land interval of several thousand miles—and an interval inhabited exclusively by members of another subgenus.

---

[1] After examining the material on which the present paper is based Mr. Miller agrees with me that *talpoides* can not be recognized.

Specimens examined.—Total number, 436, from the following localities:

Ontario: Rat Portage, Lake of the Woods, 6; Ottawa, 2.

Nova Scotia: Digby, 8.

North Dakota: Pembina, 1; Harwood, 1; Portland, 9.

Minnesota: Tower, Vermillion Lake, 3; Elk River, 25; Steele County, 4; Ortonville, 8; Two Harbors, 1.

Nebraska: Valentine, 2; Kearney, 2; Blair, 1; Columbus, 4.

Iowa: Council Bluffs, 8; Knoxville, 2.

Kansas: Onaga, 2.

Missouri: Kimmswick, 1.

Illinois: Dekalb, 2.

Michigan: Frankfort, 3; Ann Arbor, 5.

Ohio: Sandusky, 1; Garrettsville, 11; Canton, 1; Ellsworth, 1.

Pennsylvania: Drurys Run, 3; Nazareth, 1.

New York: Adirondacks, 8; Locust Grove, Lewis County, 77; Lake George, 33; Elizabethtown, 25; Alder Creek, 2; Syracuse, 2; Peterboro, 2; Troy, 1; Sing Sing, 4; Roslyn, Long Island, 1; Shelter Island, 1; Montauk Point, Long Island, 20.

New Hampshire: Ossipee, 10; Mount Washington, 1.

Maine: North Sebago, 1.

Massachusetts: Wilmington, 15; West Dedham, 3; Wareham, 25; Provincetown, 2; Seekonk, 2; Marthas Vineyard, 5; Nantucket, 1.

New Jersey: Tuckerton, 5.

Maryland: Baltimore, 1; Laurel, 1; Sandy Spring, 6; Locust Grove, 1.

District of Columbia: Washington, 35.

North Carolina: Roan Mountain, 16; Magnetic City, 5; mountains of Bun-County, 4; Old Richmond, 2.

Indiana: Richmond, 1.

BLARINA BREVICAUDA CAROLINENSIS (Bachman). Carolina Blarina.

Pl. 1, fig. 1; pl. 3, figs. 1, 5, 12.

Sorex carolinensis Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, 1837, 366–370, Pl. XXIII, fig. 1. (From South Carolina.)

Aud. and Bach., Quadrupeds N. Am., II, 1857, 176–178, Col. Pl. LXXV.

Blarina carolinensis Baird, Mammals N. Am., 1857, 45–47.

Type locality.—Eastern South Carolina.

Geographic distribution.—Austroriparian fauna from the mouth of Chesapeake Bay to Arkansas.

Habitat.—Woodlands and open fields, living in tunnels and runways just beneath the surface.

General characters.—Size intermediate between *brevicauda* and *parva;* pelage glossy and velvety, as in *brevicauda;* hind foot small, as in *parva.*

Color.—Uniform dark sooty plumbeous, more or less tinged with brownish, especially in summer; indistinctly paler below.

Cranial and dental characters.—Compared with *B. brevicauda* the skull of *B. carolinensis* is much smaller and lighter (averaging 19 to 20 mm. in greatest length and 10 mm. in breadth); occipital plane more arched;

mandible much less massive and with only a trace of the angle of the ramus; upper lateral incisors relatively broader at base and more nearly vertical (not sloping strongly forward); first premolar (5th unicuspid) usually not visible from outside.

Measurements.—Average of 6 specimens from Columbia, S. C. (presumably near type locality): Total length, 99.5 mm.; tail vertebræ, 20.5 mm.; hind foot, 12.5 mm. Average of 9 specimens from Washington, Miss.: Total length, 94 mm.; tail vertebræ, 20 mm.; hind foot, 12.2 mm.

General remarks.—*Blarina carolinensis* is merely a small edition of *B. brevicauda*, lacking the more accentuated features of the latter in the way of massiveness and angularity of the skull and lower jaw. It differs also in the lateral unicuspidate teeth. They are more nearly vertical and the fifth is generally hidden when viewed from the outside.

In geographic distribution it is strictly confined to the Austroriparian fauna. It thus inhabits the southern half of the region inhabited by *B. parva*, and the two occur together in many localities.

Blarina carolinensis was described by Bachman in 1837, and has had the good fortune to escape synonyms. It is intermediate in size, but not in characters, between the northern *Blarina brevicauda*, with which it intergrades, and the southern *B. parva*, from which it differs subgenerically (having 32 instead of 30 teeth). Intergrades with *brevicauda* are confined to a narrow strip just above the upper edge of the Austroriparian zone. Such intergrades have been examined from Cape Charles, Va.; Eubank, Ky.; Kimmswick, Mo., and the following places in southern Indiana: Brookville, New Harmony, Vigo County, and Putnam County. Specimens from Richmond, Ind., are nearer *brevicauda* than *carolinensis*.

Specimens examined.—Total number, 97, from the following localities:

Virginia: Belle Haven, 1; Cape Charles, 16; Kinsale, 1; Old Point Comfort, 1.
Kentucky: Eubank, 3; Hickman, 4.
Tennessee: Big Sandy, 1.
North Carolina: Raleigh, 39.
South Carolina: Columbia, 6; Lanes, 1; Georgetown, 1.
Georgia: Augusta, 1; Riceboro, 1.
Alabama: Greensboro, 1.
Mississippi: Washington, 10.
Arkansas: Beebe, 1.
Indiana: New Harmony, 2; Brookville, 4; Vigo County, 1; Putnam County, 2.

BLARINA CAROLINENSIS PENINSULÆ subsp. nov. Everglade Blarina.

Type from Miami River, Dade County, Fla. No. 70874, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected March 2, 1895, by J. Alden Loring. Original number, 2777.

Geographic distribution.—Peninsula of Florida, south of latitude 28°.

Habitat.—Swampy places, chiefly in Everglades.

General characters.—Similar to *B. carolinensis*, but with larger hind feet and more slaty coloration; molariform teeth larger.

Color.—Upper parts uniform slate black, duller below; lacks the sepia-brown tint of *carolinensis.*

Cranial and dental characters.—Skull similar to that of *B. carolinensis*, but somewhat larger and heavier, with broader and more massive pterygoids. The upper molariform teeth are decidedly larger, heavier, and less emarginate posteriorly. The large upper premolar is broader, especially in front, and differs in form from that of *carolinensis.*

Measurements (taken in flesh).—Type: Total length, 97 mm.; tail vertebræ, 20 mm.; hind foot, 13.5 mm.

Average measurements of 6 specimens from peninsular Florida: Total length, 97 mm.; tail vertebræ, 18.5 mm.; hind foot, 13.5 (or 14) mm.

General remarks.—*Blarina peninsulæ* is the Tropical Florida representative of the Austroriparian *B. carolinensis.* It is common in the Everglades, where Mr. Loring secured four specimens on Miami River, on the east coast, and one at Everglade (near Chocoloskee), on the west coast. He also trapped one at Micco, Brevard County.

BLARINA TELMALESTES[1] sp. nov. Dismal Swamp Blarina.

Pl. 2, fig. 5.

Type from Lake Drummond, Dismal Swamp, Virginia. No. 71823, ♀ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected June 6, 1895, by A. K. Fisher. Original number, 1775.

Geographic distribution.—Dismal Swamp, Virginia.

General characters.—Similar to *B. brevicauda*, but more plumbeous in color; hind feet relatively longer; skull narrower; molariform teeth peculiar. Length of skull, including incisors, 24 mm.

Color.—Uniform dark plumbeous or slate gray above and below, slightly darker on the rump and nose; feet and tail blackish.

Cranial and dental characters.—Compared with its nearest relative, *Blarina brevicauda*, the skull of *B. telmalestes* is narrower, less massive, with less thickened anterior nares; the coloring on the teeth is paler and much less extensive, not reaching the crowns of the teeth except on the apices of the cusps; the large upper premolar and molars, particularly m^2, differ materially in shape, the postero-internal lobe being much more broadly rounded and the posterior concavity much deeper. The thickened angular cusp on the inner side is less marked and there is a much more pronounced and thickened rim running round the posterior lobe, defining a broad saucer-shaped depression. In actual size the skull is slightly shorter than specimens of *brevicauda* from Nebraska and western Iowa, but it is longer than those from New England and the Eastern States generally.

General remarks.—From the standpoint of geographic distribution *Blarina telmalestes* is by far the most interesting member of the genus. While closely resembling the large *B. brevicauda* in size and general appearance, it is completely surrounded by the small *B. carolinensis*. It is in effect therefore an insular form, like those inhabiting the summits of high mountains within the range of more southern species. Its semi-aquatic habits, necessitated by its watery environment, have led to the unusual development of the hind feet, and the distinctive character of the molars may have resulted from some peculiarity of food.

---

[1] *Telmalestes*, from τέλμα, swamp + ληστής, robber.

Measurements (taken in flesh).—Type specimen: Total length, 118 mm.; tail vertebræ, 28 mm.; hind foot, 16 mm. Average of 13 specimens from type locality: total length, 119.5; tail vertebræ, 26.4; hind foot, 16.

Subgenus CRYPTOTIS Pomel.

1848. *Cryptotis* Pomel, Archiv. Sci. Phys. and Nat. Genève, IX, Nov. 1848, 249. Type, *Sorex cinereus* Bach. (= *Sorex parvus* Say).

1877. *Soriciscus* Coues, Bull. U. S. Geol. and Geog. Surv., 1877, 649. "Type *Sorex parvus* Say or *S. cinereus* Bach."

Diagnosis.—Teeth, 30; unicuspids, 4, never in two pairs; fourth always smaller and usually minute; basal lobe of middle incisor a rounded cusp (pl. 3, figs. 2, 3, 13, 14). Brain case more or less arched, highest anterior to lambdoid suture; plane of occiput arched.

Geographic distribution.—Broadly, the less arid parts of the Austral region in Mexico, Guatemala, Costa Rica, and the eastern United States. One species (*parva*) pushes northward in the United States through the Upper Austral or Carolinian zone; one (*tropicalis*) reaches southward into the Tropical region of Mexico and Guatemala, and several ascend the mountains of Mexico into the Boreal.

Number of representatives.—The great majority of American Short-tailed Shrews belong to the subgenus *Cryptotis*. Sixteen species and subspecies are here recognized, contrasted with 4 of *Blarina* proper and 2 of *Notiosorex*. The subgenus attains its greatest development in the highlands of southern Mexico. The species may be roughly assembled in 4 groups: (1) The *parva* group, comprising *parva*, *floridana*, *berlandieri*, *tropicalis*, *soricina*, *orophila*, and *obscura* (the latter approaching the next); (2) the *mexicana* group, comprising *mexicana*, *goldmani*, *peregrina*, *machetes*, *nigrescens*, and *nelsoni;* (3) the *alticola* group, comprising *alticola* and *fossor;* and (4) the *magna* group, comprising, so far as known, the single species of that name.

It is of little consequence whether closely related forms are treated as species or subspecies. When intergradation is known or strongly suspected, or the degree of differentiation slight, the animals are classed as subspecies. In the case of two the smaller forms here accorded specific rank (*floridana* and *berlandieri*) it is not improbable that in each instance intergradation will be found with *parva* (but not with one another) when specimens are collected from intermediate localities.

KEY TO SPECIES AND SUBSPECIES.

Size very large (total length about 130 mm.; hind foot, 17 mm.) .... *magna*
Size medium or small (length 108 mm. or less):
  1. Size medium (length, about 100 to 108 mm.; hind foot, 13 to 15 mm.):
    2. Large upper premolar deeply excavated posteriorly—
      Large upper premolar with antero-internal angle well developed .... *alticola*
      Large upper premolar with antero-internal angle broadly rounded off.. *fossor*
    2.^{1} Large upper premolar not deeply excavated posteriorly—
      3. Total length, 106 mm. or more:
        Hind foot about 15 mm.. *machetes*
        Hind foot about 13 mm.. *nelsoni*
      3.^{1} Total length, about 100 mm.:
        4. Unicuspidate teeth with strongly developed cusplet on inner side:
          Brain case abruptly inflated above plane of rostrum .... *mexicana*
          Brain case only slightly elevated above plane of rostrum .... *goldmani*
        4.^{1} Unicuspidate teeth with inner cusplet feebly developed .... *peregrina*
  1.^{1} Size small (length less than 93 mm.; hind foot, 13 mm. or less).
    Size smallest; tail about 16 mm.; hind foot, about 10.5 mm......... *parva*
    Size larger; tail 19 mm. or longer; hind foot, 12 to 13 mm.:
     Color sooty plumbeous; tail, about 25 mm.—
       Large upper premolar deeply excavated behind............. *soricina*
       Large upper premolar not deeply excavated behind......... *obscura*
     Color ash gray or brown—
       Total length, about 93 mm.; tail, about 25 mm............. *tropicalis*
       Total length, less than 90 mm.; tail, 22 mm. or less—
         Color iron gray to sepia brown.......................... *floridana*
         Color chestnut brown to ash brown.................... *berlandieri*

BLARINA PARVA (Say). Small Blarina.

Pl. 1, figs. 5, 6; pl. 3, figs. 2, 6, 13.

1823. *Sorex parvus* Say, in Long's Expedition to the Rocky Mountains, I, 1823, 164. (From near Blair, Nebr.)
1837. *Sorex cinereus* Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, 1837, 373–376, Pl. XXIII, fig. 3. (From Goose Creek, 22 miles from Charleston, S. C.)
1857. *Blarina exilipes* Baird, Mammals N. Am., 1857, 51–53. (From Washington, Miss.)
1857. *Blarina eximius* Baird, Ibid, p. 52 (provisional name based on specimens from St. Louis, Mo. and Dekalb Co., Illinois.)
1858. Kennicott, Quadrupeds of Illinois, Report Commissioner of Agriculture for 1857, 1858, p. 97.

Type locality.—West bank of Missouri, near Blair, Nebr. (formerly Engineer Cantonment, 3 miles above mouth of Boyer River).

Geographic range.—Austral region of the eastern United States (including both the Austroriparian and Carolinian faunas) from Texas and eastern Nebraska eastward to the Atlantic. Not known from New York or New England.

Habitat.—Chiefly open fields and meadows.

General characters.—Smallest of the United States species; cranium light and *Sorex*-like.

Color.—Upper parts varying from sepia to dark hair-brown, darker in winter pelage; under parts ash gray; tail bicolor, each side concolor with body. Some specimens (immature?) are nearly iron gray, lacking the sepia, in this respect resembling immature specimens of *floridana.*

Cranial and dental characters.—Skull small, about equaling *berlandieri*, but decidedly smaller than *floridana.* Last upper unicuspid not usually visible from outside; second unicuspid shorter than in *berlandieri* (pl. 3, fig. 2); upper molars (m^1 and m^2) deeply excavated behind (pl. 3, fig. 13), thus differing from both *floridana* and *berlandieri* which are only slightly concave.

Measurements (taken in flesh).—Average of 13 specimens from type locality (Blair, Nebr.): Total length, 79 mm.; tail vertebræ, 16 mm.; hind foot, 10.6 mm. Average of 25 from Raleigh, N. C.:[1] Total length, 75 mm.; tail vertebræ, 16.4 mm.; hind foot, 10.6 mm. One specimen from Washington, Miss.: Total length, 80 mm.; tail vertebræ, 18 mm.; hind foot, 11 mm.

General remarks.—*Blarina parva* is the smallest of the Short-tailed Shrews known from the United States. Specimens from New Jersey, and from the coast region of southern South Carolina and Georgia, are somewhat larger than the typical form. Thus specimens from Tuckerton, N. J., Georgetown, S. C., and Riceboro, Ga., are appreciably larger than those from Raleigh, N. C. But they agree with true *parva* in the extent and depth of color of the chestnut tips of the teeth and in the deep excavation of the molars posteriorly, thus showing no approach toward *B. floridana.*

Specimens examined.—Total number, 114, from the following localities:

Nebraska: Blair (type locality), 13.
Indiana: Brookville, 2; Irvington, 2; Terre Haute, 2; Vigo County, 2; Putnam County, 2.
Ohio: Garrettsville, 1.
New Jersey: Tuckerton, 3.
Maryland: Laurel, 1; Sandy Spring, 19.
District of Columbia: Washington, 1.
Virginia: Dismal Swamp, 1.
North Carolina: Raleigh, 46; Bertie County, 5.
South Carolina: Georgetown, 1.
Georgia: Riceboro, 4.
Alabama: Mobile, 1.
Mississippi: Washington, 1.
Louisiana: Iberia Parish, 1.
Texas: Gainesville, 5; Del Rio, 1.

---

[1] For these measurements I am indebted to the collectors, H. H. and C. S. Brimley, of Raleigh.

BLARINA FLORIDANA sp. nov. Small Florida Blarina.

Pl. 1, fig. 7.

Type from Chester Shoal, 11 miles north of Cape Canaveral, Brevard County, Fla. No. $\frac{16510}{23937}$, U. S. Nat. Mus., Department of Agriculture collection. Collected April 22, 1889, by Morris M. Green. Original number, 44.

Geographic distribution.—Peninsular Florida, south of latitude 29°. Exact limits of range unknown.

Habitat.—Palmetto scrub.

General characters.—Similar to *B. parva*, but larger, with longer skull, whiter teeth, and larger molars, which are less deeply emarginate posteriorly.

Color.—Upper parts in winter uniform iron gray, with a decided 'pepper and salt' appearance; in summer, browner and more inclined to sepia; under parts paler.

Cranial and dental characters.—Skull similiar to that of *parva*, but longer (18 instead of 16 mm.); last unicuspid visible from outside; color of teeth paler and restricted to tips of cusps; posterior border of large molars (m^1 and m^2) only slightly concave, as in *berlandieri*, not deeply excavated as in *parva*. The large molariform upper premolar has only a relatively shallow emargination behind, instead of the deep excavation of *parva*; and the notch on the front of the inner side is much smaller, and does not reach all the way down vertically (see pl. 3, fig.14).

Measurements.—Average of 2 specimens from type locality: Total length, 89 mm.; tail vertebræ, 22 mm.; hind foot, 12 mm.

General remarks.—It is interesting from a geographic standpoint to note that in essential characters *Blarina floridana* agrees with *B. berlandieri*, which latter animal likewise inhabits an extension of the tropical fauna into the United States. That the two are not connected around the Gulf of Mexico is evident from the fact that specimens from southern Louisiana and Mississippi are very different, agreeing in the characters of their molars with true *parva*. Baird had a single specimen of this species, of which he said: "A very badly preserved specimen in alcohol from Indian River, Florida, exhibits some differences, especially in the longer tail and larger size generally, including the skull and feet. For the present, however, I shall refer it to *B. cinerea*."[1]

Specimens examined.—Only 4 specimens of *floridana* have been examined—2 from the type locality, Chester Shoal, 11 miles north of Canaveral; 1 from Micco, and 1 from Gainesville.

---

[1] Baird, Mammals N. Am., 1857, 49

BLARINA BERLANDIERI Baird. Rio Grande Blarina.

Pl. 3, figs. 3, 7, 10, 14.

1857. *Blarina berlandieri* Baird, Mammals N. Am., 1857, 53-55.

Type locality.—Matamoras, Tamaulipas, Mexico.

Geographic distribution.—Lower Rio Grande Valley, on both sides of the river, and probably the coast region of southern Texas also. Limits of range unknown.

General characters.—Size a little larger than *B. parva;* pelage relatively short; upper lateral incisors long and nearly vertical.

Color.—Upper parts in summer ash brown, with a 'pepper and salt' appearance; tips of hairs in winter pelage almost chestnut; under parts grayish.

Cranial and dental characters.—The upper part of the rostrum seems to be a little more swollen in *berlandieri* than in *parva*, but it is almost impossible to separate the two by cranial characters. The lateral upper incisors (i^3 in particular), when unworn, are higher and more vertical in *berlandieri*, as shown in pl. 3, fig. 3, contrasted with that of *parva*, pl. 3, fig. 2. The best character I have discovered is the shape of the posterior border of the upper molars. In *B. parva* the hinder border of m^1 and m^2 is deeply excavated, much as in the large premolar; in *B. berlandieri* the premolar is much the same, but m^1 and m^2 are only slightly concave behind. In young specimens the large size of the second unicuspid is usually marked, contrasted with *B. parva.*

General remarks.—I have compared a series of specimens from Brownsville, Tex., with Baird's types from Matamoras (on the Mexican side of the river) and find no differences whatever. One of Baird's specimens (No. 1794) is young and has unworn teeth. The lateral incisors (first and second unicuspids) are very long and rather slender, and the apex of the second curves slightly backward. This is the specimen figured by Dobson in his Monograph of the Insectivora, Part III, fasc. 1, Pl. XXIV, fig. 7. It is closely matched by one of our specimens from Brownsville (No. 48810). In the other specimens the tip is worn off, and consequently is not recurved. Whether *berlandieri* is more than a subspecies of *parva* can not be determined from the material at hand.

It is an interesting coincidence that the character of most weight separating *berlandieri* from *parva* is shared by *floridana*, namely, the shallow emargination of the posterior border of m^1 and m^2.

Measurements (taken in flesh).—Average of 6 specimens from Brownsville, Tex. (on opposite side of river from type locality): Total length, 83 mm.; tail vertebræ, 19 mm.; hind foot, 12 mm.

Specimens examined.—Total number, 8, from the following localities:

Matamoras, Tamaulipas, Mexico (type locality), 2.
Brownsville, Tex., 5.
San Diego, Duval County, Tex., 1.

BLARINA TROPICALIS[1] Merriam. Tropical Blarina.

Pl. 1, fig. 8.

1843. *Corsira tropicalis* Gray, Proc. Zool. Soc., London, 1843, 79. *Nomen nudum.*
1861. *Sorex micrurus* Tomes, Proc. Zool. Soc., London, 1861, 279. (From Coban Guatemala.)
1877. *Blarina micrura* Alston, Proc. Zool. Soc., London, 1877, 446; Biologia Centrali-Americana, Mammalia, 1880, 56, 57, Pl. V, fig. 2.
1877. *Blarina* (*Soriciscus*) *micrura* Coues, Bull. U. S. Geol. and Geog. Surv. Terr., 638, footnote.

Type locality.—Coban, Guatemala (altitude about 4,400 feet).

Geographic distribution.—Tropical fauna of western Guatemala and southern Mexico in States of (Chiapas?) Oaxaca and Vera Cruz.

General characters.—Size small, only a little larger than *B. parva* of the United States.

Color.—Upper parts dull cinereous hair-brown, with 'pepper and salt' appearance from admixture of black-tipped hairs; under parts ashy.

Cranial and dental characters.—Skull small, but larger and more angular than that of *parva* and decidedly broader than *floridana;* brain case essentially on plane of rostrum, with only a shallow sulcus between; hinder margin of palate slightly thickened on median line, suggesting a projection. Second unicuspid with inner cusplet prominent and projecting well inward; third unicuspid without inner cusplet; molariform teeth only slightly concave behind; large upper premolar with antero-internal angle prominent and without distinct step behind, the inner border of the tooth more on a plane than usual.

Measurements.—Mean of the two original type specimens from Coban, Guatemala, as measured by Tomes (converted into millimeters): Head and body, 60 mm.; tail, 23.6 mm.; hind foot, 11.4 mm. Average of 6 specimens from Pluma and Juquila, Oaxaca (measured in flesh): Total length, 93 mm.; tail vertebræ, 25 mm.; hind foot, 12 mm.

General remarks.—In pushing northward in the tropical belt (tierra caliente) of Vera Cruz to Catemaco (altitude, 1,000 feet), the Valley of Orizaba (altitude, 4,000 feet), and Jico (altitude, 4,800 feet) *Blarina tropicalis* undergoes certain changes in cranial and dental characters that foreshadow *B. soricina* of the Valley of Mexico (altitude, 7,600 feet). The brain case becomes narrower and less angular, and the large upper premolar more concave posteriorly. Mr. Nelson contributes the following note on the habits of this animal:

---

[1] When *Sorex micrurus* Tomes (1861) was transferred to the genus *Blarina* it became preoccupied by *Galemys* (*Brachysorex*) *micrurus* Pomel (1848), which is a synonym of *Blarina brevicauda* (Say), and therefore is not available. No other name seems to have been proposed for the species except *tropicalis* Gray, which is a *nomen nudum.* The name, however, is peculiarly appropriate, the species being closely restricted to tropical America; hence I here reinstate it to replace *micrurus,* but it will have to date from the present paper. For *Galemys micrurus* Pomel, see Archiv. Sci. Phys. et Nat. Genève, IX, Nov. 1848, 249.

> At Jico this small, pale-colored Shrew was found only in the immediate vicinity of town at an altitude of about 4,600 feet. There they were not uncommon in rather dry, grassy situations under or near hedges bordering fields near the canyon just east of the town. Most of the specimens secured were taken in *Arvicola* runways. Their preference for rather high and dry situations was the converse of the habits of the other two species of Shrews found here.

A single specimen from Tuxtepec, Oaxaca (No. 65425), has the large upper premolar unusually broad, and its posterior border moderately excavated. It resembles a specimen from Choapam, Oaxaca (No. 68555), except that the latter has the premolar less broad.

At Juquila, Oaxaca, Mr. Nelson found *Blarina tropicalis* living under logs in damp places; at Orizaba, Vera Cruz, they were in thick grass in the valley.

I have not seen the type of *B. tropicalis*, but have assumed that the specimens from Pluma and Juquila, Oaxaca, are sufficiently near the type form to be used as a standard of comparison for specimens taken at points farther north.

Specimens examined.—Total number, 25, from the following localities in southern Mexico:

State of Oaxaca: Pluma, 2; Juquila, 7; Choapam, 1; Tuxtepec, 1.
State of Vera Cruz (specimens not typical): Catemaco, 1; Orizaba Valley, 5; Jico, 8.

BLARINA SORICINA sp. nov. Sorex Blarina.

Pl. 1, fig. 9.

Type from Tlalpam, Valley of Mexico (altitude, 7,600 feet). No. 50762, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected December 5, 1892, by E. W. Nelson. Original number, 3989.

General characters.—Similar to *B. tropicalis* in size and general appearance, but much darker, and with narrower, *Sorex*-like skull.

Color.—Upper parts uniform sooty black; under parts paler and browner.

Cranial and dental characters.—Skull resembling that of *B. micrura* in size, but narrower, less angular, and more *Sorex*-like; brain case in particular, higher, narrower, and more rounded. Third unicuspid larger and with chestnut-tipped cusplet on inner side (obsolete in *tropicalis*); large upper premolar broader and rather deeply excavated posteriorly; first upper true molar excavated posteriorly; inferior molars much smaller.

Measurements (taken in flesh).—Type: Total length, 88 mm.; tail vertebræ, 23.5 mm.; hind foot, 12.5 mm. Average measurements of 3 specimens from type locality: Total length, 91 mm.; tail vertebræ, 26.5 mm.; hind foot, 12.5 mm.

General remarks.—*Blarina soricina* is very distinct from typical *tropicalis*, but its relationship to the form of *tropicalis* inhabiting the tropical belt at Jico, Vera Cruz, directly east of the Valley of Mexico, is much closer and more perplexing. The Jico animal agrees with true *tropicalis* in coloration, but is more or less intermediate in cranial and dental characters. It differs from *soricina* in smaller third and fourth unicuspids (the antero-posterior diameter of third much reduced), less deeply excavated premolar, and absence of excavation in first upper true molar.

Mr. Nelson caught three of these small Blarinas under the banks of a weedy ditch close to the railway station at Tlalpam.

BLARINA OBSCURA sp. nov.

Type from Tulancingo, Hidalgo, Mexico (altitude, 8,500 feet). No. 55634, ♀ yg. ad., U. S. Nat. Mus., Department of Agriculture collection. Collected August 27, 1893, by E. W. Nelson. Original number, 5377.

General characters.—Similar to *B. mexicana*, but smaller and decidedly paler.

Color.—Upper parts dark plumbeous, overlaid by sepia, becoming dusky over the rump; under parts paler plumbeous, tipped with brownish; sides of nose dusky.

Cranial and dental characters.—Similar to *B. mexicana*, but much smaller; rostrum and teeth nearly the same size in both, but postpalatal part of cranium much smaller and shorter; first, second, and third unicuspidate teeth broad at base, with well-developed inner cusplet; large upper premolar only slightly concave behind and with antero-internal angle and cusp well marked.

Measurements (taken in flesh).—Type: Total length, 89 mm.; tail vertebræ, 24 mm.; hind foot, 13 mm. Average of 2 specimens from type locality: Total length, 92 mm.; tail vertebræ, 25 mm.; hind foot, 13 mm.

General remarks.—Only two specimens of this new *Blarina* were obtained by Mr. Nelson. They were caught in fir woods on the mountains near Tulancingo, at an altitude of 8,500 feet, and were living in small runways under the shelter of old logs.

BLARINA MEXICANA[1] Baird. Mexican Blarina.

Pl. I, fig. 11.

1877. *Blarina* (*Soriciscus*) *mexicana* (Baird MS.) Coues, Precursory Notes, Am. Insectivorous Mammals, May, 1877, 652-653. (From Jalapa, Mexico.)
1880. *Blarina mexicana* Alston, Biologia Centrali-Americana, Mammalia, Feb. 1880, 57.

Type locality.—Jalapa, Vera Cruz, Mexico. (No. $\frac{3525}{4438}$, U. S. Nat. Mus.)

Geographic distribution.—Tropical fauna of southeastern Mexico in States of Vera Cruz and Oaxaca.

General characters.—Size medium (total length, about 100 mm.; hind foot, 13 mm.); coloration very dark.

---

[1] This animal is probably not the same as *Blaria mexicana* Gray, List of Osteological Specimens in British Museum, 1847, pp. XI and 23, from Coban, South America = Coban, Guatemala. The latter is a *nomen nudum*.

Color.—Dusky or sooty, darkest on back and rump; under parts faintly washed with brownish; feet and tail blackish.

Cranial and dental characters.—Skull in size, angularity, and general characters almost indistinguishable from that of *Blarina carolinensis*, except that the brain case and occiput are higher. The brain case is inflated and rises abruptly above plane of rostrum. Cusps of unicuspidate teeth relatively slender and pointed, that of the second vertical or inclined slightly backward; cusplet on inner side strongly developed and chestnut-tipped. Upper molariform teeth only slightly concave posteriorly. Chestnut tips of all the teeth strong and extending well down.

Measurements.—Average of 22 specimens from Jico, Vera Cruz (practically the type locality): Total length, 99 mm.; tail vertebræ, 27 mm.; hind foot, 13.3 mm.

General remarks.—So far as known, *Blarina mexicana* is the most widely dispersed species of the genus inhabiting southern Mexico. It is common in damp oak forests on the mountains, where its runways resemble those of *Microtus*. The typical form is from Jalapa, Vera Cruz, near the southeastern base of the table-land. Most of the colonies from isolated mountains differ appreciably from the type, and in several the differentiation has gone so far as to necessitate subspecific recognition, as in the forms here described under their names *machetes*, *peregrinus*, and *goldmani*.

Concerning the habits of the typical form Mr. Nelson writes:

> This Shrew was rather common about Jico, and still more numerous along the lower border of the oak forest between the altitudes of 5,500 and 6,000 feet. Near Jico they were found mainly in *Arvicola* runways along the border of the canyons or along ditches bordering fields. They were also found with *Reithrodontomys* and *Sitomys* along the lower border of the oak forest. They live in damp situations grown up rankly with grass and weeds. In several places their little trails were found threading their way among the plant stems and terminating in a small hole at each end.

Specimens examined.—Total number, 110, from the following localities in southern Mexico:

State of Vera Cruz: Jalapa (type), 1; Jico, 29; Las Vigas, 2; Orizaba, 11.

State of Oaxaca: Reyes, 13; Cerro San Felipe, 22; near Cajones, 2; Totontepec, 9; Mount Zempoaltepec, 24.

BLARINA MEXICANA PEREGRINA subsp. nov.

Type from mountains 15 miles west of city of Oaxaca, Mexico (altitude, 9,500 feet). No. 68317, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected September 12, 1894, by E. W. Nelson and E. A. Goldman. Original number, 6748.

General characters.—Similar to *B. mexicana* in size and color, but with distinctive dental characters.

Color.—Dusky or sooty black, becoming slightly paler below.

Cranial and dental characters.—Skull similar to that of *mexicana*, but rostrum less swollen; unicuspidate teeth with inner cusplet nearly obsolete and without chestnut tip; molariform teeth more deeply concave posteriorly; m^2 with postero-internal lobe larger than antero-internal (reverse of *mexicana*).

Measurements (taken in flesh).—Type: Total length, 106 mm.; tail vertebræ, 31 mm.; hind foot, 15 mm. Average measurements of 20 specimens from type locality: Total length, 101.5 mm.; tail vertebræ, 30 mm.; hind foot, 14 mm.

General remarks.—This subspecies may be recognized most easily by the obsolescence of the postero-internal cusplet of the unicuspidate teeth. Of the forms described in the present paper, it is the least worthy of recognition by name. At the same time, the constancy of its characters and the geographic remoteness of the high mountains it inhabits from the home of typical *mexicana* seem to entitle it to stand. Mr. Nelson found it living in grassy meadows and forests on the mountains, where it had runways like those of the other species. Twenty-five specimens were secured at altitudes varying from 8,800 to 9,500 feet.

BLARINA MEXICANA GOLDMANI subsp. nov. Goldman's Blarina.

Type from mountains near Chilpancingo, Guerrero, Mexico (altitude, 10,000 feet). No. 70244, ♂ yg. ad., U. S. Nat. Mus., Department of Agriculture collection. Collected December 23, 1894, by E. W. Nelson and E. A. Goldman. Original number, 7231.

General characters.—Similar to *B. mexicana* in size and general appearance, but head and shoulders more plumbeous (less dusky) and under parts very much paler.

Color.—Upper parts sooty plumbeous, darkest on rump; bridge of nose darker than rest of head; under parts plumbeous, decidedly paler than upper parts.

Cranial and dental characters.—Skull similar to that of *mexicana*, but brain case flatter, only slightly elevated above plane of rostrum. Unicuspidate teeth narrower at base; large upper premolar broader behind antero-internal cusp and more excavated posteriorly.

Measurements (taken in flesh).—Type: Total length, 100 mm.; tail vertebræ, 28 mm.; hind foot, 13 mm. Average measurements of 5 specimens from type locality: Total length, 100 mm.; tail vertebræ, 28.5 mm.; hind foot, 13.2 mm.

General remarks.—*Blarina goldmani* is closely related to *B. mexicana*, differing chiefly in paler under parts, flatter brain case, and slight dental characters. The close resemblance is surprising, in view of the remoteness of the type localities of the two and the great difference in altitude at which they live. The 5 specimens on which the present species is based were collected in damp thickets among fir trees at an elevation of 10,000 feet.

BLARINA MEXICANA MACHETES subsp. nov. Ozolotepec Blarina.

Type from mountains near Ozolotepec, Oaxaca (altitude, 10.000 feet). No. 71456, ♀ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected March 26, 1895, by E. W. Nelson and E. A. Goldman. Original number, 7723.

General characters.—Similar to *B. mexicana* in color and general appearance, but somewhat larger, with decidedly larger fore and hind feet, and peculiar dental characters.

Color.—Dusky or sooty black; bridge of nose darker than rest of face; under parts dark in fresh pelage, but more or less ashy in old pelage.

Cranial and dental characters.—Skull similiar to that of *mexicana*, but slightly larger; brain case less elevated above slope of rostrum; unicuspids with inner cusplet smaller and not chestnut tipped; large upper premolar longer, broader, and more excavated posteriorly, with antero-internal angle and cusp less developed; molars larger and more concave behind; lower molars larger.

Measurements (taken in flesh).—Type: Total length, 104 mm.; tail vertebræ, 31 mm.; hind foot, 15 mm. Average measurements of 7 specimens from type locality: Total length, 108 mm.; tail vertebræ, 30.5 mm.; hind foot, 15 mm.

General remarks.—This is a well-marked form of the *mexicana* series, and it comes from the southernmost locality from which any member of the group has thus far been obtained. Mr. Nelson found it among willows in a cold boggy place in the woods, on the north slope of the mountains, at an altitude of 10,000 feet, where its runways were conspicuous and where 7 specimens were obtained.

BLARINA NELSONI sp. nov. Nelson's Blarina.

Type from Volcano of Tuxtla, Vera Cruz, Mexico (altitude, 4,800 feet). No. 65437, ad., U. S. Nat. Mus., Department of Agriculture collection. Collected May 13, 1894, by E. W. Nelson and E. A. Goldman. Original number, 6253.

General characters.—Similar to *B. mexicana* in size, general appearance, and color, perhaps even darker; differs in important cranial and dental characters.

Color.—Uniform sooty brown.

Cranial and dental characters.—Compared with *B. mexicana* the skull is larger and heavier; brain case larger, flatter, and not abruptly elevated above plane of slope of rostrum; interpterygoid fossa much broader. Molariform teeth decidedly broader and heavier; large upper premolar very broad posteriorly, but not excavated, its antero-internal angle and cusp well developed and followed by a sulcus, behind which the tooth immediately broadens. Unicuspidate teeth with inner cusplet nearly obsolete. In some respects the skull resembles *alticola* more than *mexicana;* it differs conspicuously from both in the broad and short interpterygoid notch. The upper molariform teeth differ from those of the *alticola* series in lacking the posterior excavation. The obsolescence of the inner cusplet of the unicuspids is even more complete than in *alticola*.

Measurements (taken in flesh).—Type: Total length, 110 mm.; tail vertebræ, 31 mm.; hind foot, 14 mm. Average measurements of 11 specimens from type locality: Total length, 106 mm.; tail vertebræ, 29 mm.; hind foot, 13.3 mm.

General remarks.—The peculiarities of *Blarina nelsoni* may be briefly summed up as follows: In external appearance it is hardly distinguishable from *B. mexicana;* the skull is larger and more closely resembles *B. alticola*, but differs from both in the remarkably broad and short postpalatal notch; the molariform teeth resemble those of *mexicana*, while the unicuspidate teeth resemble those of *alticola*. So far as known, the species is restricted to the isolated volcano of Tuxtla, where Mr. Nelson secured a dozen specimens. Mr. Nelson states that it is common in the forest on the mountain and ranges up to the extreme summit, at an altitude of 5,400 feet. Like most of the other species, it makes trails or runways under the shelter of roots and logs.

BLARINA ALTICOLA sp. nov. Popocatepetl Blarina.

Type from Mount Popocatepetl, Mexico (altitude, 11,500 feet). No. 52047, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected February 25, 1893, by E. W. Nelson. Original number, 4396.

Geographic distribution.—Higher slopes of Mount Popocatepetl and the mountains near Salazar and Ajusco, south of the City of Mexico (from 9,500 to 12,000 feet altitude).

General characters.—Size, medium, slightly larger than the *mexicana* group; hind foot decidedly larger than that of *mexicana* or any other Mexican species except *magna*.

Color.—Sooty plumbeous, decidedly paler on the belly, but without line of demarcation.

Cranial and dental characters.—Skull similar to that of *mexicana*, but somewhat larger; brain case narrower and less sharply angular laterally. Molariform teeth much larger and much more deeply excavated posteriorly, especially the large upper premolar, which tooth has the antero-internal angle and cusp strongly developed; unicuspidate teeth with thicker and blunter crowns.

Measurements (taken in flesh).—Type: Total length, 107 mm.; tail vertebræ, 26 mm.; hind foot, 15 mm. Average measurements of 5 specimens from type locality: Total length, 104 mm.; tail vertebræ, 26 mm.; hind foot, 15 mm.

General remarks.—This species is very distinct from any thus far discovered except the *B. fossor* here described, which is closely related. Externally it resembles *Blarina brevicauda* of the United States, but is smaller. It differs from the *mexicana* series in larger size, much larger hind foot, and in the dental characters just mentioned. It is a high mountain form living in damp, sheltered places on wooded hillsides and under sacaton grass, at an altitude of 9,500 to 12,000 feet.

Specimens examined.—Total number, 10, from the following localities, all in the State of Mexico: Mount Popocatepetl, 5; Salazar, 3; Ajusco Peak, 1; north slope of volcano of Toluca, 1.

BLARINA FOSSOR sp. nov. Zempoaltepec Blarina.

Type from Mount Zempoaltepec, Oaxaca, Mexico (altitude, 10,500 feet). No. 68545, ♀ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected July 10, 1894, by E. W. Nelson and E. A. Goldman. Original number, 6419.

Geographic distribution.—Higher slopes of Mount Zempoaltepec (from 8,200 to 10,500 feet altitude).

General characters.—Similar to *B. alticola* in size, large fore claws, and general characters, but darker, and with differences in molariform teeth.

Color.—Sooty plumbeous, becoming slightly paler anteriorly; root of nose darker than rest of head; under parts indistinctly paler and with a slight brownish cast.

Cranial and dental characters.—Compared with *B. alticola*, to which it is closely related, the skull is slightly shorter. The length of the molariform series is essentially the same, but the unicuspid series is shorter. Upper molariform teeth narrower; large upper premolar decidedly different in form, lacking the antero-internal angle, which is completely rounded off, leaving the tooth much narrower in front than that of *alticola*.

Measurements (taken in flesh).—Type: Total length, 111 mm.; tail vertebræ, 29 mm.; hind foot, 15 mm. Average of 5 specimens from type locality: Total length, 108 mm.; tail vertebræ, 29 mm.; hind foot, 14.6 mm.

General remarks.—On Mount Zempoaltepec Mr. Nelson secured 5 specimens of this new *Blarina*, 25 of *B. mexicana*, and 1 of *B. magna*.

BLARINA MAGNA sp. nov. Big Mexican Blarina.

Pl. 1, fig. 10.

Type from Totontepec, Oaxaca (altitude, 6,800 feet). No. 68575, ♂, old, U. S. Nat. Mus., Department of Agriculture collection. Collected July 24, 1894, by E. W. Nelson and E. A. Goldman. Original number, 6493.

Geographic distribution.—Mountains about Totontepec and Mount Zempoaltepec, Oaxaca (from 6,800 to 8,000 feet altitude).

General characters.—Size largest of subgenus *Cryptotis*, equaling *Blarina brevicauda;* tail long (more than 40 mm.); color dusky; tail scant haired.

Color.—Everywhere dull sooty brown, hardly paler below; chin and throat washed with brownish chestnut (which may be due to food-staining).

Cranial and dental characters.—Skull resembling that of *Blarina brevicauda* in size and general appearance, but narrower, with longer rostrum and more arched brain case. The brain case in profile is strongly convex, and the highest point is near junction of posterior and middle thirds. Unicuspidate teeth narrow, with inner cusplet very small. Molariform teeth not at all excavated posteriorly, and without interspaces. Large upper premolar short and broad, with antero-internal angle broadly rounded off.

Measurements (taken in flesh).—Type: Total length, 134 mm.; tail vertebræ, 42 mm.; hind foot, 17 mm.

General remarks.—*Blarina magna*, owing to its very large size, does not require comparison with any known species. The tail is very long for a *Blarina* (45 percent of the length of head and body). A specimen from Mount Zempoaltepec lacks the chestnut-brown wash on the throat. Mr. Nelson states that the runways of this large *Blarina* are conspicuous in the dense, damp oak forest of the mountains. Only two specimens were obtained.

Average measurements of the species of Blarina.

[All measurements are in millimeters and from fresh specimens.]

Name of species.	Locality.	Total length.	Tail vertebræ.	Hind foot.	Number of specimens.
Blarina brevicauda	Council Bluffs, Iowa	127	26.6	16.5	8
	Lake George, New York	121.5	26.7	14.8	31
	Locust Grove, Lewis County, N. Y.	121	25	14.6	58
telmalestes	Dismal Swamp, Virginia	119.5	26.4	16	13
carolinensis	Columbia, S. C	99.5	20.6	12.5	6
	Raleigh, N. C	93.3	20.3	11.6	63
	Washington, Miss	94	20	12.2	9
peninsulæ	Everglades of Florida	96.8	18.5	13.5	6
parva	Blair, Nebr	79	16	10.6	13
	Raleigh, N. C	75.6	17	10.1	25
floridana	Canaveral, Fla	89	22	12	2
berlandieri	Brownsville, Tex	83	19	12	6
tropicalis	Pluma and Juquila, Oaxaca, Mexico	93	25	12	6
soricina	Tlalpam, D. F. Valley of Mexico	91	26.5	12.5	3
obscura	Tulancingo, Hidalgo, Mexico	92.5	25	13	2
mexicana	Jico, Vera Cruz, Mexico	99	27	13.5	22
goldmani	Mountains near Chilpancingo, Guerrero, Mexico.	100	28.5	13.2	5
peregrina	Mountains near Oaxaca, Mexico	101.5	30	14	20
machetes	Mountains near Ozolotepec, Oaxaca, Mexico.	108	30.5	14.9	7
nelsoni	Volcano of Tuxtla, Vera Cruz, Mexico	106	29	13.3	11
alticola	Mount Popocatepetl, Mexico, Mexico	104	26	15	5
fossor	Mount Zempoaltepec, Oaxaca, Mexico	108	29	14.6	5
magna	Totontepec, Oaxaca, Mexico	134	42	17	1 (type)

Cranial measurements of typical specimens of Blarina.

Name.	Locality.	Greatest length (including front incisor).	Greatest breadth.
Blarina brevicauda	Blair, Nebr. (type locality)	25.4	14
telmalestes	Dismal Swamp, Virginia (type)	24	12
carolinensis	Columbia, S. C. (near type locality)	19	10
peninsulæ	Miami River, Florida (type)	20.3	10.5
parva	Blair, Nebr. (type locality)	16.5	7.5
floridana	Canaveral, Fla. (type)	18.2	8
berlandieri	Brownsville, Tex. (near type locality)	16.8	7.8
soricina	Tlalpam, Valley of Mexico (type)	18	8.2
tropicalis	Pluma, Oaxaca, Mexico	18.2	8.8
obscura	Tulancingo, Hidalgo, Mexico (type)	18	9.8
mexicana	Jico, Vera Cruz, Mexico (near type locality)	20	10.5
goldmani	Mountains near Chilpancingo, Guerrero, Mexico (type)	20	10
peregrina	Mountains near Oaxaca, Oaxaca, Mexico (type)	20.3	10.2
machetes	Mountains near Ozolotepec, Oaxaca, Mexico (type)	20	9.8
nelsoni	Volcano of Tuxtla Vera Cruz, Mexico (type)	20.5	10.5
alticola	Mount Popocatepetl, Mexico, Mexico (type)	21	10.3
fossor	Mount Zempoaltepec, Oaxaca, Mexico (type)	21.2	10.7
magna	Totontepec, Oaxaca, Mexico (type)	24.5	11.5

NOTE.—The following two species of the subgenus *Cryptotis* were described by Dr. Allen after the present paper was in paged proof. Dr. Allen has kindly sent me the type specimens, and I am glad to be able to add the following descriptions:

BLARINA OROPHILA Allen.

Blarina (*Soriciscus*) *orophila* Allen, Bull. Am. Mus. Nat. Hist., New York, VII, p. 340, November 8, 1895.

Type locality.—Volcano of Irazu, Costa Rica.

"Pelage glossy, very short, soft and velvety. Above dark brown (shading slightly on seal brown), becoming lighter on the sides, and passing gradually into smoke gray on the ventral surface, where the hairs are conspicuously tipped with whitish. Feet grayish brown; tail dusky above, distinctly lighter below, well clothed, and with a minute pencil at tip. Ears rudimentary and not easily detected.

"*Measurements.*—Head and body, 55 mm.; tail vertebræ, 21 mm.; hind foot, 11 mm.; head, 20 mm.

"*Skull* (too imperfect for complete measurements).—Length of nasals, 5 mm.; length of upper tooth row, 8 mm.; distance between outer borders of last molars, 5.5 mm."

General remarks.—*Blarina orophila* is closely related to *B. tropicalis*, from which it differs in the shape of the bases of the first and second unicuspids when viewed from the outer side; they are narrow and have a pinched appearance instead of being broadly rounded off. The anterior cusp of the large upper premolar, to which Dr. Allen calls attention, is not longer than in *tropicalis* and falls far short of the middle cusp of the same tooth.

BLARINA NIGRESCENS Allen.

Blarina (*Soriciscus*) *nigrescens* Allen, Bull. Am. Mus. Nat. Hist., New York, VII, p. 339, November 8, 1895.

Type locality.—San Isidro (San Jose), Costa Rica.

"Pelage coarse, rather long, and not lustrous. Above dusky plumbeous, in some lights black; lower surface not appreciably different. Feet and tail blackish, nearly naked, the annulations of the latter being distinctly visible.

"*Measurements.*—Head and body, 65 mm.; tail vertebræ, 22 mm.; hind foot, 12 mm.

"*Skull.*—Total length, 20 mm.; mastoid breadth, 9.5 mm.; length of nasals, 7 mm.; length of upper tooth row, 9 mm.; distance between outer edges of last molars, 6.3 mm."

General remarks.—*Blarina nigrescens* is closely related to *B. nelsoni*, from which it may be distinguished by the even larger size of the large upper premolar. This tooth is exceedingly broad transversely and is strongly convex on its inner side. Its anterior cusp is nearly obsolete, while in *nelsoni* it is well developed. As in *nelsoni*, all the molariform teeth are very large and very slightly excavated posteriorly. The unicuspidate teeth have the inner cusplet fairly developed; in *nelsoni* it is nearly obsolete. The skull is slightly smaller, and the brain case narrower behind than in *nelsoni*.

Genus NOTIOSOREX Baird, 1877.

Notiosorex (subgenus of *Sorex*) Baird in Coues, Bull. U. S. Geol. and Geog. Surv., III, 1877, 646–647.

Notiosorex (full genus) Dobson, Mon. Insectivora, Part III, 1890, Pl. XXIII, fig. 20.
Flower and Lydekker, Introduction to Study of Mammals, 1891, 624.
Merriam, Proc. Biol. Soc. Washington, VII, 1892, 26.

Dental formula.—i, $\frac{3}{2}$; c, $\frac{1}{0}$; pm, $\frac{1}{1}$; m, $\frac{3}{3} = \frac{8}{6} \times 2 = \frac{16}{12} = 28$.

Teeth; 28; unicuspids, 3, forming a uniform series, the third more than half as large as second, never minute. Unicuspids narrow at base, without trace of secondary cusplet on inner side. Anterior teeth lightly tipped with orange; molars pure white. Cranium flat and broadly rounded. External ear conspicuous; tail short, less than half the length of head and body; body slender.

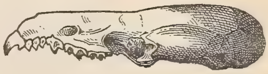


Fig. 2.—Skull of *Notiosorex*.

Geographic distribution.—Lower Sonoran fauna of the United States and Mexico, from southern Texas to southern California and southward in Mexico to Mazatlan, Sinaloa and the peninsula of Lower California.

HISTORY AND NOMENCLATURE.

The genus *Notiosorex* is exceptionally free from complications of nomenclature and synonymy. It was described and named by Baird in 1861, but was not published until 1877, when Coues incorporated it, along with other of Baird's manuscript descriptions, in his Precursory Notes on American Insectivorous Mammals.[1] The original type species was described by Baird under the name *Sorex* (*Notiosorex*) *crawfordi*, and came from Fort Bliss, N. Mex. (practically El Paso, Tex.). In the same publication Coues described a specimen from Mazatlan, Mexico, as a new species and named it *Sorex* (*Notiosorex*) *evotis*. No other species have been described, and there are no synonyms, unless *evotis* should prove a synonym of *crawfordi*.

Notiosorex was proposed as a subgenus of *Sorex*. It is accorded ful, generic rank by Dobson and by Flower and Lydekker. It is closely related to the Eurasian genus *Crocidura*, but the skull is much broader and flatter posteriorly. It is doubtful if the differences that separate it from *Crocidura* are of more than subgeneric weight.

NOTIOSOREX CRAWFORDI Baird.

Sorex (*Notiosorex*) *crawfordi* Baird, Bull. U. S. Geol. and Geog. Surv., III, 1877, 651–652. (From Fort Bliss, N. Mex.). Thomas, Proc. Zool. Soc. London, 1888, 444. (From San Diego, Duval County, Tex.).

Type from near Fort Bliss, New Mexico (practically El Paso, Texas). (No. $\frac{2653}{4437}$, U. S. Nat. Mus.)

Geographic distribution.—Parts of Lower Sonoran zone from eastern Texas to southern California, and thence southward to the cape region of the peninsula of Lower California.

General characters.—Size small, about equaling *Blarina parva;* ears large for a Shrew, protruding conspicuously beyond the fur; hind feet and tail short, the latter about half the length of the body without the head; color plumbeous.

Color.—Upper parts plumbeous (near the 'olive gray' of Ridgway); under parts whitish; tail bicolor, each side concolor with body.

Cranial and dental characters.—The cranial and dental characters have been described in the generic diagnosis. The first and second unicuspids are large and subequal; the third also is large, considerably more than half the second. Judging from Dobson's figure of the teeth of *evotis* (which he calls *crawfordi:* Mon. Insectivora, Part III, 1890, Pl. XXIII, expl.) those of *crawfordi* are less crowded. The large upper premolar and molars are rather deeply excavated posteriorly, especially the latter.

Measurements of type specimen (alcoholic, as recorded by Coues, converted into millimeters).—Head and body, 48 mm.; tail vertebræ, 28 mm.; hind foot, 10 mm. An alcoholic specimen in the Department collection (No. 31532) from San Diego, Tex., measures: Total length,

---

[1] Bull. U. S. Geol. and Geog. Surv., III, No. 3, 1877, 646.

82 mm.; tail vertebræ, 26 mm.; hind foot, 10.5 mm.; ear, 6.5 mm. Mean of 3 alcoholics from San Diego, Tex. (as measured by Thomas): Head and body, 56 mm.; tail vertebræ, 28 mm.; hind foot, 10 mm. Skull of type specimen: Total length (including front incisors), 17.3 mm.; greatest breadth, 8 mm.

General remarks.—Notiosorex crawfordi is either a very rare animal or very local and difficult to capture, as only a few specimens have found their way into museums, and most of these were collected in Duval County, Texas, by Mr. William Taylor. The Department of Agriculture collection contains one from San Diego, Texas, collected by William Lloyd; one from San Antonio, Texas, collected in 1890 by Mr. H. P. Attwater, and there is one in the Merriam collection from San Bernardino, California, collected April 19, 1886, by Mr. F. Stephens. The latter is the only one known from California and has not previously been recorded.

While this paper is passing through the press two specimens have been received from Santa Anita in the southern part of Lower California. They were collected by J. Ellis McLellan, May 13 and 18, 1895.

The type specimen of *crawfordi* was described as an alcoholic in very bad condition. It is now little more than a skeleton, but the skull is in good condition, except that the occiput has been injured. The color of the type as described by Baird from the alcoholic specimen was "light chestnut brown above." This is the color of the alcoholic San Diego specimens. But no dependence can be placed on the color of alcoholic Shrews, since most of them change to chestnut or reddish brown. The skin from San Antonio lacks the chestnut and is nearly uniform plumbeous, slightly browner above. The specimen from San Bernardino, Calif., which was at first assumed to be an undescribed species, agrees so closely with the San Antonio specimen that I am unwilling to separate it even subspecifically. It is plumbeous above, paler below, with the hairs of the back faintly washed with brownish. Thus the only two specimens of *Notiosorex* from the United States that have not been in alcohol are plumbeous, washed with brownish instead of chestnut, while all the alcoholics that have been examined (about half a dozen) have the upper parts strongly washed with chestnut.

Skulls of *Notiosorex crawfordi* from San Antonio and San Diego, Texas, are identical with that of the type. The skull from San Bernardino, Calif., differs from the type in the following points: Size slightly smaller; muzzle more abruptly narrowed anteriorly; angle of tooth row (seen in profile) greater at junction of molariform teeth with unicuspidate series; large upper premolar larger (outer side longer and transverse diameter greater). But these differences are not sufficient to warrant separation.

NOTIOSOREX CRAWFORDI EVOTIS (Coues).

Sorex (*Notiosorex*) *evotis* Coues, Bull. U. S. Geol. and Geog. Surv., III, 1877, 652. (From Mazatlan, Mexico.)

Notiosorex crawfordi Dobson (*not* Baird), Mon. Insectivora, Part III, 1890, Pl. XXIII, fig. 20. (From Mazatlan, Mexico.)

Type from Mazatlan, Sinaloa, Mexico. (No. 9066, U. S. Nat. Mus.)

Geographic distribution.—Neighborhood of Mazatlan; range unknown.

General characters.—Similar to *N. crawfordi*, but slightly larger and darker.

Color.—Upper parts plumbeous, the tips of the hairs ashy or brownish; under parts soiled whitish.

Cranial and dental characters.—The skull of *evotis* I have not seen, the skull of the type having been lost or mislaid in the United States National Museum; but Dobson has figured the teeth of a specimen from the type locality (Mon. Insectivora, Part III, fasc. 1, 1890, Pl. XXIII, fig. 20), which, if correct, indicates that the teeth are more crowded than in *crawfordi*, and the second or middle unicuspid smaller, being intermediate in height between the first and third. In *crawfordi* the first and second are essentially subequal.

Measurements of type specimen (from dry skin, as recorded by Coues, converted into millimeters).—Head and body, 73 mm.; tail vertebræ, 23 mm. [probably 25 mm.]; hind foot, 11.5 mm.

General remarks.—In the absence of sufficient material of *N. evotis*, it is impossible to determine its exact relations to *crawfordi*. Dobson did not recognize it as distinct, but figured its teeth under the name *crawfordi*. For the present it seems best to retain it as a subspecies.

THE LONG-TAILED SHREWS OF THE EASTERN UNITED STATES.

By Gerrit S. Miller, Jr.

During the summer of 1894 I was enabled, through the kindness of Mr. Oldfield Thomas, to examine in the British Museum the original specimens of three Shrews (*Sorex palustris*, *S. forsteri*, and *S. parvus*) described by Richardson nearly seventy years ago, but since then not positively identified. In explaining the results of this study it is necessary to consider all the Long-tailed Shrews of the eastern United States.

Writers on the Shrews of eastern North America have without exception worked with inadequate material, and, as a result, left the nomenclature in a chaotic state. Thus, to the common *Sorex personatus* no less than ten specific names have been applied, while another species (*Sorex forsteri* Baird *nec* Richardson) has been allowed to go unnamed. On the other hand, certain names—as, for instance, *Sorex forsteri* or *Sorex richardsoni*—have been used to designate as many as three species. Much of this confusion is the result of a lack of appreciation of the facts that in determining closely allied Shrews it is necessary to compare specimens in the same phase of pelage, and in which the original form of the teeth has not been sensibly altered by wear. The extent to which the form of the teeth changes with age is shown in Pl. IV, fig. 8, as compared with figs. 5, 6, and 7. That there is much individual variation in the form and relative size of the teeth is another circumstance which has not been properly taken into account. As a result, specimens of one Shrew have been referred to two or more species placed in different sections of the genus. Variation of this kind is illustrated by figs. 5, 6, and 7 of Pl. IV, which show the unworn unicuspid teeth of three specimens of *Sorex personatus* taken at one locality. The seasonal changes in color are much greater than has been supposed. *Sorex albibarbis* is in summer nearly unicolor, while in winter the belly is so much paler than the back and sides as to give the animal a resemblance to the bicolored *S. palustris*. Many specimens of *Sorex fumeus* taken during mid-summer are by color alone with difficulty separated from *S. personatus*, to which in winter it bears no likeness. In most Shrews the fur is noticeably longer and softer in autumn and winter than in summer, and at the same time the colors are richer and more strongly contrasted.

In preparing the following revision of the species of *Sorex* occurring in the United States east of the Great Plains I have examined about 500 Shrews from that region. This material is in part from my own collection and the private collections of Dr. C. Hart Merriam, Mr. Outram Bangs, and Mr. S. N. Rhoads. I have also had at my disposal, in addition to the specimens in the British Museum already referred to, the Shrews belonging to the American Museum of Natural History, the United States Department of Agriculture, and certain specimens determined by Baird in the United States National Museum.

The three most important studies of the Shrews of eastern North America are those of Bachman, 1837;[1] Baird, 1857,[2] and Dobson, 1890.[3] The following table shows the names used by these authors for the seven species admitted in the present paper.

	Bachman, 1837.	Baird, 1857.	Dobson, 1890.
Sorex hoyi		S. hoyi	S. hoyi.
		S. thompsoni	
palustris			S. palustris.
albibarbis			
richardsoni	S. richardsoni	S. pachyurus	S. vulgaris (= S. araneus).
fumeus		S. forsteri	S. platyrhinus.
		S. richardsoni	
longirostris	S. longirostris	S. personatus?	
personatus	S. forsteri	S. cooperi	S. richardsoni.
	S. fimbripes	S. platyrhinus	S. personatus.
	S. cooperi	S. haydeni	S. haydeni.

The subject is so complicated that it is necessary to consider in detail the history of each species.

Sorex hoyi.—*Sorex hoyi* was first described in 1857 by Baird, and since then has been almost unknown. At present there are perhaps two dozen specimens in collections. *Sorex thompsoni*, from Burlington, Vt., described in the same paper with *S. hoyi*, is probably indistinguishable from the latter.

In 1877 Dr. Coues published in his Precursory Notes on American Insectivorous Mammals[4] a diagnosis by Baird of the subgenus *Microsorex* based on *Sorex hoyi.* In this paper, as well as in the original description of the species, Baird overlooked the minute fourth incisor and stated that *Sorex hoyi* had only 30 teeth. This error was not detected until 1890, when Dobson figured the teeth correctly.

Sorex palustris.—The first notice of an American Marsh Shrew was published in 1828, when Richardson described *Sorex palustris*,[5] an animal which he had found frequenting the borders of lakes in the region between Hudson Bay and the Rocky Mountains.

---

[1] Jour. Acad. Nat. Sci. Phila., VII, Part II.

[2] Mamm. N. Am.

[3] Mon. Insectivora, Part III, fasc. 1.

[4] Bull. U. S. Geol. and Geog. Surv., III, No. 3, 1877.

[5] Zool. Jour., III, p. 517.

In 1857 Baird placed *Sorex palustris* among the species unknown to him, but which he considered as probably worthy of recognition. At the same time he described the new genus *Neosorex* and the species *Neosorex navigator*, from Washington.

Our first accurate knowledge of *Sorex palustris* dates from 1890, when Dr. Dobson figured the teeth of the type specimen,[1] and in another paper published the same year[2] discussed the validity of the genus *Neosorex*. Dr. Dobson came to the conclusion that *Sorex palustris* and *Neosorex navigator* are the same, and that *Neosorex*, so far from being a genus, can not even be recognized as a subgenus. A year later Dr. Merriam recorded *Sorex palustris* from Idaho, at the same time remarking that he considered *Neosorex* a very good subgenus.[3]

The type specimen of *Sorex palustris* in the British Museum is dingy and discolored. For years it was exhibited as a mounted specimen, but is now kept as a skin. In color it is unlike any Shrew that I have seen, but resembles *S. bendirii* more than any other. The fur is gone from the middle of the belly, but what remains on the chin, throat, and sides agrees in color with that of the corresponding parts in *S. bendirii*. The color is, however, so obviously unnatural that it can not be considered of any importance, especially as it is not in the least as described by Richardson. Reasons have already been given for believing that Richardson's name should be applied to the paler-bellied western form of Marsh Shrew (Proc. Bost. Soc. Nat. Hist., XXVI, March 24, 1894, 181, 182), and after examining the type I see no necessity for changing this opinion. The specimen being in such condition as to furnish no evidence, it is still necessary to judge the old descriptions on their own merits. As all the early accounts of *Sorex palustris* refer to its pale, ash-gray belly, and as the geographical range—indefinite though it is—coincides with that of the western animal, it is proper to apply the name to the latter. That the type of *Sorex palustris* is a *Neosorex* and not an *Atophyrax* is shown by the teeth, which are nearly unworn.[4]

Sorex albibarbis.—The type of *Sorex albibarbis* was taken by Prof. E. D. Cope in 1859 at Profile Lake, New Hampshire. The original description of the species appeared three years later in the Proceedings of the Philadelphia Academy of Sciences.[5]

Soon after Professor Cope published his account of *Sorex albibarbis* Prof. A. E. Verrill recorded a specimen from Warwick, Mass., and attempted to prove the identity of the animal with Richardson's *Sorex palustris*.[6] In this attempt he was so far successful that he has been followed by Mr. J. A. Allen in his Catalogue of the Mammals of Mass.[7]

---

[1] Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 18.

[2] Proc. Zool. Soc. London, p. 51.

[3] N. Am. Fauna No. 5, p. 35, July, 1891.

[4] The teeth as figured by Dobson (Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 18) appear somewhat too deep from apex to root.

[5] Proc. Acad. Nat. Sci. Phila., 1862, p. 188.

[6] Proc. Bost. Soc. Nat. Hist., IX, p. 164, 1862.

[7] Bull. Mus. Comp. Zool., I, p. 211, 1869.

In 1892, however, Dr. Merriam enumerated both *Sorex albibarbis* and *S. palustris* among the mammals of the boreal zone,[1] while two years later the species was again recorded from Profile Lake, New Hampshire, and also from Essex County, N. Y.[2] Still more recently Mr. Rhoads has taken *S. albibarbis* in Pennsylvania.[3]

Sorex richardsoni.—The American representative of *Sorex araneus* was discovered by Forster, who in 1772 recorded the species from Hudson Bay. Although Forster called the animal *Sorex araneus* he noticed that it had a blacker back and brighter colored sides than the common European Shrew.

The species was next described by Richardson in the Fauna Boreali-Americana (1829). Here it was referred with some hesitation to *Sorex parvus* Say, a Shrew which is not even congeneric with *S. richardsoni.* The specimen on which Richardson based his description of *Sorex parvus* is in the British Museum, and though faded and dingy is perfectly identifiable. The color pattern can still be distinctly seen, while in size it agrees exactly with a specimen from Elk River, Minnesota.

In 1837 Bachman, who already felt convinced that the Shrews called *Sorex parvus* by Richardson and Say were not the same, received a specimen from Mr. William Cooper, on the strength of which he named Richardson's animal *Sorex richardsoni.* Cooper's specimen came from the Northwest Territory, which in the early thirties embraced the present States of Wisconsin, Iowa, Minnesota, northern Illinois, and the northern peninsula of Michigan. As the *Sorex parvus* of Richardson is known to occur in this region, and as nothing in Bachman's description points to any other animal, the propriety of applying to it the name *richardsoni* is hardly open to question, though there is the possibility that the Cooper specimen was really *S. fumeus.*

The animal was not noticed again until the year 1857, when Baird described a specimen in full winter coat as a new species under the name *Sorex pachyurus.* The *Sorex richardsoni* of Baird is a pale, worn summer specimen of *S. fumeus.*

The most recent mention of *Sorex richardsoni* is by Dobson, who figures the teeth for the first time. Dobson, like Forster, referred the animal to *Sorex vulgaris* [= *S. araneus*], the species to which it is certainly most nearly allied.

Sorex fumeus.—The large slaty-plumbeous Shrew characteristic of the Canadian fauna was first described by Baird in 1857. Baird had two specimens, one from Carlisle, Pa., and the other from Racine, Wis. These he identified respectively as *Sorex forsteri* [= *S. personatus*] and *Sorex richardsoni*, species widely different from each other and from *Sorex fumeus.* Both specimens are now in the National Museum. The type of Baird's *forsteri* is in the dark autumnal or winter pelage, and hence recognizable at a glance from the external characters alone. The original of his *richardsoni*, on the other hand, is a much worn summer specimen, the determination of which might be a matter of uncertainty were it not for the excellent condition of the teeth and anterior part of the skull, which show it to be unquestionably *Sorex fumeus*.

---

[1] Proc. Biol. Soc. Washington, VII, p. 25, 1892.

[2] Miller, Proc. Bost. Soc. Nat. Hist., XXVI, p. 183, 1894.

[3] Proc. Acad. Nat. Sci., Phila. 1894, 395, Jan., 1895.

From 1857 to 1890 *Sorex fumeus* escaped notice. The references to *Sorex forsteri* and *S. richardsoni* during this period are based on Baird's statements concerning the species rather than on identification of specimens. In 1890, however, Dobson figured the teeth of an individual from Lake George, New York. This specimen he identified with De Kay's *Otisorex platyrhinus*, a totally different animal.

That this species should have remained until now unnamed is a matter of surprise. Nevertheless, a careful examination of the literature shows that none of the many names proposed for North American Shrews can be applied to it. Of these names it is necessary to consider in the present connection *Otisorex platyrhinus* De Kay and *Sorex platyrhinchus* Linsley only. The former was based on a specimen from Tappan, Rockland County, N. Y. The essential part of the original description is as follows:

> Characteristics: Dark brown, paler beneath. Total length, 4 inches.
>
> Description: * * * Ears very large, rounded and membranaceous, subangular on the upper margin, sparsely covered within and without with long hairs; * * * hind feet slender, 0.8 inch long, sparsely covered with light rufous hairs; * * * fur over whole body quite long and thick, ranging from 0.2 to 0.4 inch; * * * teeth minute, tinged with piceous at their tips. Dental formula: Incisors, $\frac{2}{2}$; cheek teeth, $\frac{18}{10}=32$. * * * Color: Dark cinereous, slightly tinged with dusky rufous, particularly on the upper part of the muzzle and inferior portion of the neck; beneath, ash gray.
>
> Length of head and body, 2.5 inches; length of tail, 1.6 inches; length of head, 0.9 inch; length of ear, 0.2 inch.

Nothing in this description refers unquestionably to the Shrew under consideration. It is true that the statements concerning the color might refer to this animal. Since, however, they apply with equal pertinence to the majority of known species of *Sorex*, they can not be considered of any diagnostic value. The stress that De Kay lays on the large ears of his specimen has led to the belief that he had in hand the larger of the two common species of *Sorex*, an animal with actually though not proportionally larger ears than *S. personatus*. The measurement—length of ear, 2 lines (4 mm.)—was made no one knows how. As it stands it is about 2 mm. shorter than the ear of *S. fumeus* measured (in the dry skin) from the meatus, while it exceeds by a full millimeter, or 33 percent, the height of ear above crown in dried specimens of the same animal.

On the other hand, *Otisorex platyrhinus* agrees in size with *Sorex personatus*. "Total length, 4 inches" (100 mm.), and "length of tail, 1.6 inches" (38 mm.), are statements which apply to the latter species and not to *S. fumeus*.[1] The measurement of the hind foot, "8 lines"

---

[1] Ten specimens of *S. personatus* average: Length, 101 mm.; tail, 38.8 mm.; while a like number of *S. fumeus* average: Length, 119 mm.; tail, 44.9 mm.

(19 mm.), is evidently an error, since it is about right for a Shrew the size of *Sorex albibarbis*, and can apply to no true *Sorex* known from the eastern United States.

Although De Kay's account of *Otisorex platyrhinus* is so faulty as to make the identification of his animal a matter of uncertainty, the description published by Linsley[1] of a specimen seen and named by De Kay is enough[2] to fix the name on the animal already called *Sorex personatus* by Isidore Geoffroy Saint Hilaire.

Sorex longirostris.—In 1837 Bachman described a Shrew from the swamps of the Santee River, South Carolina.[3] This animal he named *Sorex longirostris.* Although there is nothing in Bachman's long account by which the animal can be positively identified, the name may be applied to a very distinct species of Shrew occurring in the Southern States. Efforts to secure topotypes of *Sorex longirostris* have thus far failed, and the nearest point to the type locality from which specimens are known is Bertie County, N. C. It is very unlikely, however, that a different Shrew occurs in the Santee region.

This Shrew is now recognized for the first time since Bachman described it, unless the *Sorex personatus* of Baird was the same. The type of Baird's *personatus* is a skin without skull of an apparently immature Shrew taken near Washington, D. C. The specimen is in such condition as to be wholly unidentifiable, and nothing is known about the Long-tailed Shrews that occur in the vicinity.

Sorex personatus.—Isidore Geoffroy Saint Hilaire described in 1827,[4] a Shrew which he called *Sorex personatus.* No type locality is given, but the original specimen was collected by Milbert in the United States, possibly in New York.[5] The description is sufficiently accurate to show that the animal was the smaller common Long-tailed Shrew of the eastern United States.

A few months later Richardson redescribed the species as *Sorex forsteri.*[6] The type in the British Musuem has been mounted, but is now kept as a skin. The fur has a peculiar brownish-fulvous cast, the result probably of long exposure. The teeth are so worn that the incisors are reduced to mere stubs. In spite of all this, there can be no doubt that the specimen is a typical *Sorex personatus.* The hind foot measures 11 mm.

---

[1] Sill. Am. Jour. Sci., XLIII, 346.

[2] This beautiful little quadruped was taken in a decayed apple-tree log in Stratford January 22, 1840. Total length, 4 inches [101.6 mm.]; body and head, 2.5 inches [63.5 mm.]; * * * length of tail, 1.5 inches [38 mm.]; * * * height of ear, .1 inch [2.5 mm.]; * * * total weight of animal, 27 grains. Color: Upper parts dark, reddish brown; nose and tail, upper side dull red, under parts dark gray or light mouse colored; end of tail a pencil of black hair; feet and legs white, or pale flesh color; * * * length of hind feet to elbow, 5; * * * orifice of the ear very large and curiously folded, being nearly 3 lines [6.25 mm.] across. It was named by Dr. De Kay, to whom I sent it, *S. platyrhinchus*, and he describes it as a subgenus, *Otisorex* * * * and he is the least and most delicate mammiferous quadruped I ever beheld.

[3] Jour. Acad. Nat. Sci. Phila., VII, Part II, p. 270, Pl. XXIII, fig. 2.

[4] Mém. Mus. d'Hist. Nat., Paris, XV, p. 122.

[5] Milbert collected the type of *Rhinichthys cataractæ* Cuv. and Val. at Niagara Falls, N. Y.

[6] Zool. Jour., III, p. 516, Jan. to Apr., 1828.

The next reference to *Sorex personatus* was made by Gapper, who described and figured the animal under the name *Sorex forsteri* in the Zoological Journal for 1830. Gapper's specimens came from the region between York and Lake Simcoe, Ontario.

The *Sorex cooperi* which Bachman named in 1837 is without doubt the present species.

Bachman's *Sorex fimbripes*, described in the same paper with *S. richardsoni* and *S. cooperi*, is said by Dr. Coues,[1] who has examined the supposed type, to be a perfectly normal *Sorex personatus.* How Bachman could see in such a specimen the remarkable characters ascribed to *S. fimbripes* is beyond comprehension. On Bachman's account of *S. fimbripes* is based the generic name *Hydrogale* Pomel.[2] The type of *Sorex fimbripes* was collected in Lycoming County, Pa., on Drurys Run, a branch of the Schuylkill River.

The *Amphisorex lesueuri* of Duvernoy[3] from Indiana, is apparently an abnormal example of *Sorex personatus.* It is said to have a whitish streak running from the eye to the corner of the mouth.

Sorex platyrhinchus Linsley and *Otisorex platyrhinus* De Kay have been discussed in detail under *Sorex fumeus.* There can be no question that both names are synonyms of *Sorex personatus.*

In 1857 Baird recognized five small Shrews from the eastern United States. Two of these—*Sorex platyrhinus* and *S. cooperi*—were based on individual variations of the present species. Specimens with the unicuspid teeth, as shown in Pl. IV, fig. 5, were referred to *S. cooperi*, while those with the teeth, as in Pl. IV, figs. 6 or 7, were called *S. platyrhinus.* At the same time Baird described as a new species *Sorex haydeni*,[4] from Fort Buford, N. Dak. Certain slight peculiarities in a few specimens from this general region indicate that *Sorex haydeni* may eventually be recognized as a local race of *S. personatus.* For the present, however, the forms are best united under the latter name.

From 1857 to 1890 *Sorex personatus* has been referred to as *S. cooperi*, *S. platyrhinus*, or *S. personatus* indifferently. In 1890, however, Dr. Dobson added to the list of synonyms by figuring the teeth of an individual from Halifax, Nova Scotia, under the name *Sorex richardsoni.*[5]

The next year Dr. Merriam described specimens from Idaho as a new species, *Sorex idahoensis.*[6]

---

[1] Bull. U. S. Geol. and Geog. Surv., III, No. 3.

[2] Archiv. Sci. Phys. and Nat., Genève, IX, 248, Nov., 1848.

[3] Magasin de Zoologie, Mamm., p. 33, Pl. L, 1842.

[4] Mamm. N. Am., p. 29.

[5] Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 9.

[6] North American Fauna, No. 5, p. 32.

In 1894 Mr. J. A. Allen recorded a large series of *Sorex personatus* from New Brunswick as *Sorex forsteri*,[1] the name first applied to the animal by Richardson more than sixty years before.

KEY TO THE SPECIES OF SOREX OCCURRING IN THE UNITED STATES EAST OF THE GREAT PLAINS.

- A distinct secondary cusp on the inner side of the canine and second and third upper incisors (subgenus *Microsorex*) .... *S. hoyi*
- No secondary cusp on the canine or any of the incisors except the first.
  - Feet conspicuously fringed; size large (total length usually more than 150 mm.; hind foot, over 18 mm). (Subgenus *Neosorex*.)
    - Distinctly bicolor; belly nearly white, in strong contrast with color of back; chin not paler than rest of ventral surface.... *S. palustris*
    - Nearly unicolor, or with belly somewhat grayer than back; chin paler than rest of ventral surface .... *S. albibarbis*
  - Feet not fringed; size medium or small (total length, less than 140 mm.; hind foot never more than 16 mm). (Subgenus *Sorex*.)
    - Average length, over 110 mm.; tail more than 40 mm.
      - A well-defined dark dorsal area .... *S. richardsoni*
      - Back not noticeably darker than sides .... *S. fumeus*
    - Average length, under 105 mm.; tail less than 40 mm.
      - Canine normally smaller than fourth incisor, rostrum broad (ratio of greatest anteorbital breadth to palatal length, 78) .... *S. longirostris*
      - Canine normally equal to or larger than fourth incisor, rostrum narrow (ratio of greatest anteorbital breadth to palatal length, 61 : 71) .... *S. personatus*

Subgenus MICRCSOREX Baird.

Microsorex Baird in Coues Precursory Notes on American Insectivorous Mammals, Bull. U. S. Geol. and Geog. Surv., III, No. 3, 646, 1877. Type, *Sorex hoyi* Baird.

Inner side of canine and second and third upper incisors with a distinct secondary cusp (fig. 1*c*); fourth upper incisor very minute and nearly hidden between the third incisor and canine; brain case low and narrow (ratio of cranial breadth to total length of skull ranging from 42 to 47); mandible short and heavy; feet never fringed.

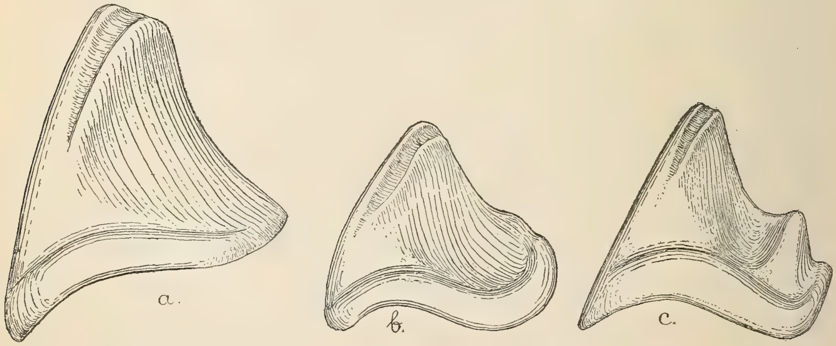


FIG. 1.—Third upper incisor (greatly enlarged and semi-diagrammatic). *a*, *Sorex araneus*; *b*, *S. personatus*; *c*, *S. hoyi*.

---

[1] Bull. Am. Mus. Nat. Hist., VI, p. 100, Apr. 24.

Baird established the subgenus *Microsorex* in 1877 in a paper published by Dr. Coues. The characters as originally given were false, since it was supposed that *Sorex hoyi*, the type of the subgenus, had only 30 teeth, while in reality it has 32, the number normally present in the genus. Although the subgenus can not be distinguished by the number of teeth, it is amply characterized by cranial and dental peculiarities which will be more fully discussed in the description of *Sorex hoyi*. The form of the skull, and especially of the mandible, in this Shrew is so peculiar as to suggest that it may be necessary eventually to recognize *Microsorex* as a full genus.

So far as known, *Microsorex* is peculiar to America, where it is represented by one species, *Sorex hoyi* Baird.

SOREX HOYI Baird.

(Pl. V, figs. 6 and 7; Pl. VI, figs. 10 and 10*a*.)

1857. *Sorex hoyi* Baird, Mamm. N. Am., p. 32. (Racine, Wis.)
1857. *Sorex thompsoni* Baird, Mamm. N. Am., p. 34. (Burlington, Vt.)
1862. *Sorex thompsoni* Verrill, Proc. Bost. Soc. Nat. Hist., IX, p. 169. (Maine.)
1890. *Sorex hoyi* Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, figs. 15, 16*a*. (New York and Manitoba.)

Type locality.—Racine, Wisconsin.

Geographic distribution.—Boreal zone and adjacent part of Transition zone from Minnesota to New Brunswick and Nova Scotia.

General characters.—*Sorex hoyi* is the only known species of *Microsorex*. It may be recognized by the subgeneric characters.

Color.—Back and sides hair brown, more or less darkened with clove brown on the former, and shading, without line of demarcation, into the pale hair brown or silver gray of the belly. Dorsum of manus and pes and ventral surface of tail pale Isabella color. Region between front legs usually tinged with fulvous.

The color of the back varies slightly, being more darkened with clove brown in some individuals than in others. The chest is often very strongly tinged with fulvous, and at least a trace of this color is present in every specimen that I have examined.

Skull.—The skull of *Sorex hoyi* (Pl. VI, figs. 10, 10*a*) is small, thin, and papery. In form it differs from that of other species of *Sorex* in the flattened and narrowed brain case and in the short thick mandible, the latter resembling that of the smaller species of *Blarina*. The peculiarities in form as compared with *Sorex personatus* and *S. richardsoni* are shown in the following table of approximate cranial ratios:

	Sorex hoyi.	Sorex personatus.	Sorex richardsoni.
Ratio of cranial breadth to total length of skull	45	51	51
Ratio of greatest anteorbital breadth to total length of skull	28	28	27
Ratio of rostral breadth to palatal length	80	70	66
Ratio of palatal breadth to cranial breadth	60	55	52
Ratio of palatal depth to cranial depth	40	51	40
Ratio of cranial depth to cranial width	49	51	53

Teeth.—The teeth of the upper molariform series can scarcely be distinguished from the corresponding teeth in *Sorex personatus*, except by the slightly different form of the excavations on the posterior borders. These excavations in *S. personatus* are deepest near the middle of the teeth, while in *S. hoyi* the deepest points are distinctly nearer the inner borders.

The unicuspid teeth of *Sorex hoyi* are (Pl. V, figs. 6, 7) slender, deep, and heavily pigmented, the colored area occupying nearly one-third of the outer face of the second and third incisors, and somewhat less on the canine. The second and third incisors are of equal height, the second slightly the larger. The canine is about half the size of the third incisor. The premolar and the fourth incisor are very minute, though both are visible from the outer side. The fourth incisor is so small that it is readily overlooked in alcoholic specimens or in skulls that are not properly cleaned. In a specimen from Trousers Lake, New Brunswick, both premolar and fourth incisor are remarkably large (Pl. V, fig. 6), but no other specimens from the Eastern States show any peculiarities to separate them from true *S. hoyi*.

The crowns of the second and third incisors, and to a less degree the canine in *Sorex hoyi* are remarkable for the prominence of the ridge forming the inner edge of the pyramidal main cusp. This ridge, which is present in all species of *Sorex*, is here greatly developed, and provided near its base with a distinct, pigmented, secondary cusp (fig. 1*c*). This cusp is not homologous with the minute cusp on the inner side of the unicuspid teeth of *Blarina*, as the latter is developed from the cingulum and is near the hinder edge of the tooth, while the secondary cusp in *Microsorex* is distinct from the cingulum and lies somewhat in front of the middle of the tooth. Although the ridge which bears the secondary cusp in *Microsorex* is not equally developed in all species of true *Sorex*, it is never entirely absent. It is greatly reduced in *S. araneus* (fig. 1*a*), *S. alpinus*, and *S. richardsoni*, much more conspicuous and sometimes even tending to form a rudimentary cusp in *S. minutus*, *S. personatus* (fig. 1*b*), and others.

The mandibular teeth, like the mandible itself, are remarkably short and strongly built. While the individual teeth are distinctly broader than in *S. personatus*, the tooth row as a whole is shorter. The teeth show no essential differences in form beyond those already noticed.

Measurements.—Unfortunately, most of the specimens of *Sorex hoyi* that I have seen were not measured in the flesh; hence it is impossible to give satisfactory measurements for the species. An alcoholic specimen from Steele County, Minn., measures: Length, 88 mm.; tail vertebræ, 27 mm.; hind foot, 10 mm. Three alcoholic specimens from Elk River, Minn., average: Length, 81.7 mm.; tail vertebræ, 30.7 mm.; hind foot, 10.7 mm.

General remarks.—Sorex hoyi differs so widely from other species of *Sorex* in its subgeneric characters that it needs no comparison with any. Superficially it has much the appearance of a small, abnormally short-tailed *S. personatus*.

Subgenus NEOSOREX Baird.

Neosorex Baird, Mamm. N. Am., p. 11, 1857. Type, *Neosorex navigator* Baird.

Inner side of canine and incisors without secondary cusps; fourth upper incisor well developed; brain case broad (ratio of cranial breadth to total length of skull ranging from 52 to 56); mandible slender and lightly built; feet conspicuously fringed with bristle-like hairs, as in *Crossopus*.

The subgenus *Neosorex* was first described in 1857 by Baird, who considered the single species known to him entitled to full generic rank. In this decision he was followed by authors until 1890, when Dr. Dobson (Proc. Zool. Soc. London, p. 51) came to the conclusion that *Neosorex* "can not even be considered as * * * a subgenus." Dr. Merriam has more recently (North American Fauna, No. 5, July, 1891, p. 35) expressed the opinion that *Neosorex* is "a very good subgenus," and this ruling appears to be the most satisfactory.

Neosorex is confined to America, and although not closely related to the Old World *Crossopus*, shows a remarkable parallelism with the latter both in habits and in external appearance. Both are aquatic, inhabiting marshes and the borders of streams, and the likeness between freshly killed specimens of the two Shrews is very remarkable. *Crossopus* is, however, the more robust animal with shorter tail and broader muzzle.

SOREX PALUSTRIS Richardson.

(Pl. V. fig. 1; Pl. VI, figs. 1 and 1*a*.)

1828. *Sorex palustris* Richardson. Zool. Jour., III, p. 517. (Hudson Bay to Rocky Mts.)
1853. *Sorex palustris* Aud. and Bach., Quadrupeds N. Am., III, p. 108, Pl. CXXV.
1890. *Sorex palustris* Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 18 (teeth of type).
1894. *Sorex palustris* Miller, Proc. Bost. Soc. Nat. Hist., XXVI, p. 183. (Minnesota.)

Type locality.—Unknown; somewhere in the region between Hudson Bay and the Rocky Mountains. (Type in the British Museum.)

Geographic distribution.—Boreal zone from Hudson Bay and central Minnesota west to the Rocky Mountains.

General characters.—*Sorex palustris* is distinguished by its subgeneric characters from all other eastern American Shrews except *S. albibarbis*. From the latter it is separated by its shorter, broader, more heavily pigmented unicuspid teeth, and the sharply defined whitish color of the belly.

Color.—Dorsal surface very dark seal brown with a slight gloss, each hair with a narrow subterminal band of smoke gray separating the seal-brown tip from the slate-gray under fur, and producing a grizzled appearance when the animal is viewed in certain lights; ventral surface very pale smoke gray, nearly white, and often faintly tinged with cream color; the color of the belly extending a short distance on the sides, where it shades quickly into the color of the back; inner surfaces of all four legs colored like the belly; dorsum of manus and pes sepia, paler on the inner half; tail clear seal brown dorsally and at tip, pale smoke gray ventrally, this gray area broad proximally, but soon narrowing to a mere line, which persists to the extreme tip.

In the worn summer coat the belly is variously discolored with brownish and yellowish, the animal usually, however, remaining sharply and distinctly bicolor.

Skull.—The skull of *Sorex palustris* is large and heavily built, with the brain case broad and high. Otherwise it does not differ essentially from the skull of *S. araneus* or *S. richardsoni*. The anterior opening of the infraorbital canal is large and elliptical in outline, sharply defined on all sides except in front. The posterior border is over a point slightly behind the middle of the first molar. Close to the posterior border of this opening is the small lachrymal foramen.[1]

Teeth.—The teeth of *Sorex palustris* are large, strong, and heavily pigmented (Pl. V, fig. 1). The molariform teeth do not differ in form from those of *S. araneus* and *S. richardsoni*, except that the posterior borders of the upper molars are more extensively excavated, the widest part of the excavation being nearer the inner borders of the teeth. The unicuspid teeth, however, show more obvious differences. The second and third incisors are subequal, the latter slightly the larger. The fourth incisor is less than half the size of the canine, which in turn is distinctly smaller than the second incisor. The premolar is minute but in the tooth row and distinctly pigmented at the tip.

Measurements.—It happens that very few of the specimens of *Sorex palustris* that I have seen were measured in the flesh. A male from South Edmonton, Alberta: Length, 157 mm.; tail vertebræ, 68 mm.; hind foot, 20 mm. Another male, from Tower, Minn.: Length, 156 mm.; tail vertebræ, 65 mm.; hind foot, 19 mm.

SOREX ALBIBARBIS (Cope).

1862. *Neosorex albibarbis* Cope, Proc. Acad. Nat. Sci. Phila., p. 188. (New Hampshire.)
1862. *Neosorex palustris* Verrill, Proc. Bost. Soc. Nat. Hist., IX, p. 164. (Massachusetts.)
1892. *Sorex albibarbis* Merriam, Proc. Biol. Soc. Washington, VII, p. 25.
1894. *Sorex albibarbis* Miller, Proc. Bost. Soc. Nat. Hist., XXVI, p. 183. (New Hampshire and New York.)

Type locality.—Profile Lake, New Hampshire.

Geographic distribution.—Boreal zone in the eastern United States and Canada from Pennsylvania north at least to Nova Scotia and Quebec. Specimens examined from Nova Scotia, Quebec (Lac aux Sables),

---

[1] I am somewhat in doubt as to the correct name for this foramen. Parker apparently alludes to it in his description of the adult skull of *Sorex araneus* (Phil. Trans. Royal Soc., CLXXVI, 213, 1886) when he says "the canal wall for the infraorbital nerve is itself perforated," though in reality the foramen in question does not open into the infraorbital canal, but on the contrary into a tube lying superficial to the latter and penetrating the skull in the direction of the nasal cavity.

New York (Essex County), New Hampshire (Profile Lake), Maine (Lincoln), and Pennsylvania (Monroe County).

General characters.—In size equal to *Sorex palustris.* Teeth narrower, longer, and less heavily pigmented than in the latter. Color of belly never sharply defined from that of the sides.

Color.—In summer: Dorsal surface very dark seal brown, almost black, with faint reflections, the hairs marked subterminally with smoke gray, thus producing a slight grizzled appearance; fur everywhere slate gray at base; ventral surface sepia, a little mixed with smoke gray, becoming clear, pale smoke gray on chin and fading insensibly into color of back; dorsum of manus and pes sepia, paler on inner side, the former also paler distally; tail clove brown dorsally, grayish ventrally. In winter: Back as in the summer pelage; belly pale hair brown or silvery smoke gray, according to light; a distinctly darker shade between the front legs and a paler area on chin. On the sides the color of belly shades gradually into that of back; otherwise as in the worn summer pelage.

Skull.—The skull of *Sorex albibarbis* (Pl. VI, fig. 2) resembles that of *S. palustris* so closely that the description of the former will suffice for both.

Teeth.—The teeth of *Sorex albibarbis* differ somewhat from those of *S. palustris* in the form and pigmentation of the unicuspids (Pl. V, fig. 2). These are slightly narrower and longer from point to base, and are less extensively pigmented at the tips than in *S. palustris.*

Measurements.—Seven adults from Elizabethtown, N. Y. Average: Length, 154.7 mm.; tail vertebræ, 71.3 mm.; hind foot, 19.3 mm. Two specimens from Profile Lake, New Hampshire, measure, respectively: Length, 157 mm.; tail vertebræ, 68 mm.; hind foot, 19 mm.; and, length, 149 mm.; tail vertebræ, 65 mm.; hind foot, 19 mm.

General remarks.—Sorex albibarbis needs comparison with *S. palustris* only. In color summer specimens of *S. albibarbis* are very different from *S. palustris* and remarkably like *S.* (*Atophyrax*) *bendirii*, a species readily distinguished by its cranial and dental characters. The winter coats of *Sorex albibarbis* and *S. palustris* sometimes resemble each other rather closely. In the former the color of the belly shades gradually into that of the back, while the chin is noticeably paler than the rest of the ventral surface. In the latter the color of the ventral surface is uniformly pale and separated from that of the back by a sharp line of demarcation. On the other hand, the two animals are, as already stated, very differently colored in summer, when *Sorex albibarbis* may be recognized at a glance by its brownish belly, *S. palustris* being then colored practically as in autumn and winter.

Subgenus SOREX Linn.

Sorex Linnæus, Syst. Nat., ed. X, p. 53, 1758. Type, *Sorex araneus* Linn.

Inner side of canine and incisor without secondary cusps (figs. 1*a*, 1*b*); fourth upper incisor well developed; brain case moderately broad (ratio of cranial breadth to total length of skull, about 50); mandible slender and lightly built; feet never fringed.

The Shrews of the subgenus *Sorex* occurring in eastern North America fall naturally into three groups. Two of these are found in Europe also; the third appears to be peculiar to America. The first, or *araneus* group, represented in Europe by the type of the genus, *Sorex araneus*, and the closely related *S. alpinus*, is replaced in eastern North America by *S. richardsoni* and *S. fumeus;* the second, or *minutus* group, to which belongs the American *S. personatus*, has for its European member *S. minutus;* the third, or *longirostris* group, contains the one species, *Sorex longirostris* Bachman. The species of the *araneus* group are characterized by their large size, strongly built skulls, and the slight development of the ridge on the antero-internal edges of the cusps of the unicuspidate teeth (fig. 1*a*). The Shrews of the *minutus* group are all small, with light papery skulls, and the antero-internal ridge on the cusps of the unicuspidate teeth well developed and occasionally showing the first suggestion of the minute secondary cusp characteristic of the subgenus *Microsorex* (fig. 1*b*). *Sorex longirostris*, also a very small animal, is distinguished from the members of the *minutus* group by its remarkably short, broad rostrum, and by the small size of the fourth incisor. This tooth in *S. longirostris* is smaller than the canine, while in the *minutus* group it is as large or larger.

SOREX RICHARDSONI Bachman.

(Pl. V, fig. 4; Pl. VI, figs. 4 and 4*a*.)

1772. *Sorex araneus* Forster, Philos. Trans., LXII, p. 381. (Hudson Bay.)
1829. *Sorex parvus* Richardson, Fauna Boreali-Americana, I, p. 8. Not *S. parvus*. Say, 1823. (No locality.)
1837. *Sorex richardsoni* Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, p. 383, Pl. XXIV, fig. 5. (Northwest Territory.)
1857. *Sorex pachyurus* Baird, Mamm. N. Am., p. 20. Not *S. pachyurus* Küster, 1835.
Dak (Pembina, ~~Minn.~~)
1890. *Sorex vulgaris* Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 4. (Manitoba.)

Type locality.—Unknown.

Geographic distribution.—Boreal zone from Minnesota and Manitoba west to Alberta. Limits of range not determined.

General characters.—Size large, equaling *S. araneus;* back with a dark median area evident at all seasons, but especially so in winter.

Color.—In winter: Fur everywhere slaty blackish at base; back with a broad, sharply defined area of very dark walnut brown extending from base of tail to occiput, beyond which it fades into color of face; this area broadest over lumbar region and shoulders, narrowest just back of shoulders; sides yellowish hair brown in striking contrast, this color clear and pure from flanks to sides of head but across the face mixing with the walnut brown of the back; belly pale hair brown; an indistinct line of demarcation between colors of belly and sides; ventral surface of tail and dorsum of manus and pes concolor with sides; tail seal brown dorsally and at tip, though not sharply bicolor. In summer: Back dull seal brown, darker over rump and lumbar region; sides light sepia, darker on shoulders and flanks; belly uniform pale broccoli brown. Feet and tail as in winter. There is in summer much more color variation than in winter. A few individuals are then as dark as in winter, but the majority are paler. The palest specimen that I have seen is dark hair brown on the back, pale sepia on the sides, and broccoli brown on the belly. The line of demarcation between the colors of the back and sides is always well marked, though the color of the latter often fades insensibly into that of the belly.

Skull.—The skull of *Sorex richardsoni* (Pl. VI, fig. 4) is indistinguishable from that of *Sorex araneus* (Pl. VI, fig. 3). The brain case is well rounded and moderately high, less so than in *Sorex palustris* and *S. albibarbis.* The rostrum is slender (narrower than in *S. fumeus*), and as compared with the species of the *minutus* group rather deep (see table, page 43). The anterior opening of the infraorbital canal is subcircular, the outline distinct on the lower and posterior borders, the posterior border over a point a little in advance of the middle of the first molar. The lachrymal foramen opens exactly over the middle of the first molar.

Teeth.—In general the teeth of *Sorex richardsoni* resemble those of *S. araneus* very closely, differing chiefly in their slightly larger size and in a few details in the proportions of the unicuspids. The latter (Pl. V, fig. 4), like the skull, are strongly and heavily built. The second and third incisors are subequal, the second usually the larger. The canine and the fourth incisor are subequal, the latter always the larger of the two and either intermediate in size between the canine and the third incisor or more nearly the size of the canine. The premolar is small, but distinctly visible from the outer side. The teeth are strongly colored at the points, the colored area on the front incisors of both jaws being continuous, and on the unicuspids occupying a little less than one-third of the outer face of the unworn teeth.

While the teeth of *Sorex richardsoni* resemble those of both *Sorex fumeus* and *Sorex araneus*, they are more like the latter. From the teeth of the former they differ in larger size, more extensive pigmentation, and greater relative size of the canine and fourth incisor. From the teeth of *S. araneus* those of *S. richardsoni* may be distinguished by the proportionally smaller premolar and larger canine. From both *araneus* and *fumeus*, *richardsoni* differs in the less extensive excavation of the posterior borders of the upper molariform teeth.

Measurements.—Ten specimens from South Edmonton, Alberta. Average: Length, 112.6 mm.; tail vertebræ, 40.1 mm.; hind foot, 13.8 mm. Maximum: Length, 118 mm.; tail vertebræ, 42 mm.; hind foot, 15 mm. Minimum: Length, 108 mm.; tail vertebræ, 38 mm.; hind foot, 13 mm,

General remarks.—While *Sorex richardsoni* is totally different in color from all other American Shrews, it closely resembles the European *Sorex araneus* Linn.[1] So close is this resemblance that the animals have been thought identical by at least two authors—Forster, in 1772, and Dobson, one hundred and twenty years later. As Forster remarks, however, the back is distinctly darker in the American animal. *Sorex richardsoni* in winter, at least, is very constant in color, but *Sorex araneus* varies so excessively at all seasons that it is not easy to make a proper comparison between the two species. In a series of about 30 of the latter collected near Lyndhurst, in the New Forest, southern England, during June, 1894, there is every shade of intergradation between specimens practically indistinguishable in color from the paler winter examples of *S. richardsoni*, and those with no distinct marking of any kind, the whole body being a dull, pale brownish drab, slightly darker on the back. Taking, however, the darker examples of *S. araneus* it is seen that the dorsal area is constantly less dark than in *S. richardsoni*, while the colored area on the sides is narrower, paler, and not so sharply defined from the color of the belly. Even in winter the fur on the back is in *S. araneus* scarcely more than half as long as in *S. richardsoni* at the same season.

The close agreement in size of *Sorex richardsoni* and *Sorex araneus* is shown by comparison of the measurements of the former with the following averages and extremes of 10 specimens of the latter animal from the New Forest, England: Average: Length, 117.9 mm.; tail vertebræ, 39.3 mm.; hind foot, 13.9 mm. Maximum: Length, 124 mm.; tail vertebræ, 42.6 mm.; hind foot, 14.8 mm. Minimum: Length, 113 mm.; tail vertebræ, 35 mm.; hind foot, 13 mm. The slight discrepancy in the total length of the two animals is more apparent than real, since it may easily be accounted for as the result of different methods of taking this measurement.

SOREX FUMEUS sp. nov.

(Pl. V, fig. 5; Pl. VI, figs. 5 and 5*a*.)

1857. *Sorex forsteri* Baird, Mamm. N. Am., p. 22. From Carlisle, Pa. (nec Richardson, 1819).

1857. *Sorex richardsoni* Baird, Mamm. N. Am., p. 24. From Racine, Wis. (nec Bachman, 1837).

1890. *Sorex platyrhinus* Dobson, Mon. Insectivora, Part III, fasc. 1; Pl. XXIII, fig. 5. From Lake George, New York (nec De Kay, 1842).

Type locality.—Peterboro, N. Y. Type, ♀ ad., No. 2582, collection of G. S. Miller, jr., taken September 24, 1893.

---

[1] *Sorex araneus* Linn., Syst. Nat., ed. X, p. 53, 1758. See Thomas, The Zoologist, p. 63, 1895.

Geographic distribution.—Boreal zone and locally the cooler parts of the Transition zone in the eastern United States, Nova Scotia, and New Brunswick, west to Ontario and the Great Lakes.

General characters.—About the size of *Sorex richardsoni.* Back without distinct dark median area. Color smoky plumbeous gray.

Color.—In autumn and winter: Back smoke gray, the hairs everywhere tipped with seal brown, producing a finely grizzled appearance; the dark tips slightly more conspicuous over rump and lumbar region, less numerous on the sides, and disappearing entirely on the belly, where the fur is pale broccoli brown. Everywhere the fur, which is slate color at base, has a faint gloss. The result is a combination of colors very hard to describe, but unlike that of any other Shrew occurring in eastern North America. Tail indistinctly bicolor, seal brown dorsally, yellowish white ventrally; feet yellowish white. In summer: Dull hair brown throughout, paler on the belly, and very slightly darker on the back.

Specimens in the dull, short summer coat are much like the average *S. personatus* in color, but are usually paler, and may always be distinguished by a peculiar bluish cast. A specimen taken at Lake George, New York, July 10, 1892, has the full, dark autumnal pelage appearing on the rump and buttocks in strong contrast with the short pale fur on the rest of the body.

Skull.—The skull of *Sorex fumeus* (Pl. VI, fig. 5) is a trifle smaller than that of *S. araneus* or *S. richardsoni.* The brain case is narrower than in the other members of the *araneus* group, while the rostrum and interorbital region are broader. The anterior opening of the infraorbital canal is larger than in *S. richardsoni* and placed farther back, the posterior border of the foramen lying over a point decidedly behind the middle of the first molar instead of in front of the middle, as in *S. richardsoni* and *S. araneus.* The lachrymal foramen is over the space between the first and second molars.

Teeth.—The teeth of *Sorex fumeus* resemble in a general way those of *S. richardsoni* and *S. araneus*, but are smaller and less pigmented. The posterior borders of the upper molariform teeth are more extensively excavated than in *S. richardsoni*, thus resembling *S. araneus.*

The unicuspid teeth in profile (Pl. V, fig. 5) are shorter and broader than in the other members of the *araneus* group. The second and third incisors are subequal, the second usually slightly the larger; the fourth abruptly smaller than the third, and distinctly larger than the canine; the first premolar very small, but visible from the outer side. When slightly worn the unicuspid teeth show a peculiarity shared by the members of the *minutus* group, but not often occurring in the allies of *S. araneus*; the points of these teeth wear away more rapidly on the outer side, so that when seen in profile the less worn inner edge often appears as a prominence suggesting an incipient secondary cusp projecting backward below the tip of the main cusp. In *Sorex araneus* and *S. richardsoni* the inner side of the cusp wears away as fast, or nearly as fast, as the outer side, and this semblance to an accessory cusp seldom appears.

Measurements.—Type specimen: Length, 116 mm.; tail vertebræ, 44 mm.; hind foot, 12.6 mm. Six others from type locality average: Length, 116 mm.; tail vertebræ, 45.4 mm.; hind foot, 13.2 mm. Seven adults from Elizabethtown, Essex County, N. Y., average: Length, 119 mm.; tail vertebræ, 43.7 mm.; hind foot, 13.1 mm.

General remarks.—*Sorex fumeus* is very different from any of the other Shrews found in the eastern United States. In size it about equals *S. richardsoni*, but is readily distinguished from the latter by the absence of a well-marked dark dorsal area and by cranial and dental characters. The anterior orifice of the infraorbital canal lies farther back in *S. fumeus*, while the unicuspid teeth are narrower and less robust, as well as different in form.

Overstuffed skins of *Sorex personatus* are superficially much like *S. fumeus* in the dull summer coat, but there is never any difficulty in determining specimens that have been measured in the flesh or that are accompanied by skulls.

SOREX LONGIROSTRIS Bachman.

(Pl. IV, figs. 2, 3, and 4; Pl. VI, fig. 9.)

1837. *Sorex longirostris* Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, p. 270, Pl. XXIII, fig. 2. (Swamps of Santee River, South Carolina.)

1857. ?? *Sorex personatus* Baird, Mamm. N. Am., p. 30. (Washington, D. C.)

Type locality.—Swamps of the Santee River, South Carolina.

Geographic distribution.—*Sorex longirostris* is at present known to occur in Bertie County, N. C., and at Raleigh, N. C.

General characters.—In size and external appearance *Sorex longirostris* is very similar to *S. personatus.* It differs from all the Shrews of the eastern United States in its broad rostrum and small fourth upper incisor.

Color.—Dorsal surface uniform sepia, faintly tinged with chestnut on rump, fading to broccoli brown on the sides, and this in turn to smoke gray on the belly; no lines of demarcation anywhere; fur everywhere slate colored at base; dorsum of manus and pes pale Isabella color; tail obscurely bicolor, sepia dorsally and at tip, dirty white ventrally. The three specimens which I have before me, all taken at Raleigh, N. C., in January and February, show no variation in color, except that one has the belly distinctly washed with broccoli brown.

Skull.—The skull of *Sorex longirostris* (Pl. VI, fig. 9) is shorter than that of *S. personatus* and has the rostrum broader as compared with the brain case. The bony palate is remarkably broad and short, the rows of unicuspid teeth being especially widely separated as compared with *S. personatus.* The anterior opening of the infraorbital canal is moderately large and subcircular in outline. The posterior border is over a point slightly in front of the middle of the first molar. The lachrymal foramen is of the same size and shape as in the other small Shrews, and is placed a little behind the middle of the first molar.

Teeth.—Except for the different proportions of the unicuspids the teeth of *Sorex longirostris* closely resemble those of *S. personatus.* The excavations on the posterior borders of the upper molariform teeth, however, are less extensive in *S. longirostris* and are widest near the middle of each tooth, while in *S. personatus* the widest part is nearer the internal border. The difference is most strongly marked in the large second premolar.

The unicuspid teeth (Pl. IV, figs. 2, 3, and 4) resemble those of no other *Sorex* found in the eastern United States. The second and third incisors are large and subequal, the latter being slightly the larger, the fourth very much smaller than the second or third, and also distinctly smaller than the canine. The first premolar is minute and just visible from the outer side. All the teeth are tipped with chestnut brown to a slightly greater extent than usual in *S. personatus.*

The teeth vary somewhat in relative size, as shown by the figures, the fourth incisor occasionally nearly equaling the canine. In one specimen the size and form of the fourth incisor differs appreciably in the opposite sides of the jaw.

Measurements.—Four adults from Raleigh, N. C. Average: Length, 87.75 mm.; tail vertebræ, 33.25 mm.; hind foot, 10.75 mm.

General remarks.—Sorex longirostris resembles *S. personatus* in external appearance, but differs from this species very widely in the remarkably broad, short rostral part of the skull. This difference is especially noticeable when the palates of the two are compared.

SOREX PERSONATUS Isidore Geoffroy Saint Hilaire.

(Pl. IV, figs. 1, 5, 6, 7, and 8; Pl. VI, figs. 7 and 8.)

1827. *Sorex personatus* I. Geoffroy Saint Hilaire, Mém. Mus. d'Hist. Nat., Paris, XV, p. 122. (United States.)
1828. *Sorex forsteri* Richardson, Zool. Jour., III, p. 516. (Fur countries to lat. 67°.)
1837. *Sorex cooperi* Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, p. 388, Pl. XXIV, fig. 7. (Northwest Territory.)
1837. *Sorex fimbripes* Bachman, Jour. Acad. Nat. Sci. Phila., VII, Part II, p. 391, Pl. XXIV, fig. 8. (Drurys Run, Pennsylvania.)
1842. *Amphisorex leseueri* Duvernoy, Magasin de Zoologie, Mamm., p. 33, Pl. L. (Wabash River, Indiana.)
1842. *Sorex platyrhinchus* Linsley, Sill. Am. Jour. Sci., XLIII, p. 346. (Stratford, Conn.)
1842. *Otisorex platyrhinus* De Kay, Zoology of New York, I, p. 22, Pl. V, fig. 1. (Tappan, Rockland County, N. Y.)
1857. *Sorex platyrhinus* Baird, Mamm. N. Am., p. 25. (Mass. and Vermont to Ohio.)
1857. *Sorex cooperi* Baird, Mamm. N. Am., p. 27. (Labrador to Massachusetts, Illinois, and Nebraska.)
1857. *Sorex haydeni* Baird, Mamm. N. Am., p. 29. (Fort Union [now Fort Buford], N. Dak.)
1857. ?? *Sorex personatus* Baird, Mamm. N. Am., p. 30. (Washington, D. C.)

1890. *Sorex personatus* Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXVIII, fig. 1 (Ottawa); Pl. XXIII, fig. 10. (Manitoba.)

1890. *Sorex richardsoni* Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 9. (Halifax, Nova Scotia.)

1890. *Sorex haydeni* Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 7.

1891. *Sorex idahoensis* Merriam, North American Fauna, No. 5, p. 32. (Idaho.)

Type locality.—United States.

Geographic distribution.—Northern North America from the Atlantic to the Pacific. In the eastern part of its range *Sorex personatus* occurs in the Boreal zone, Transition zone, and locally in the northernmost part of the Upper Austral zone.

General characters.—*Sorex personatus* is one of the smallest Shrews occurring in the eastern United States. It is slightly larger than *S. longirostris*, from which, while not differing widely in color, it is readily distinguished by its slender muzzle as well as by dental characters.

Color.—Dorsal surface of body sepia tinged with chestnut on rump, lumbar region, and sides of head, fading on the sides of the body; belly, throat, and chin silvery smoke gray or pale broccoli brown; no sharp line of demarcation between color of belly and sides, but change taking place rather abruptly. Throughout the pelage the hairs are slate color at base. On the back, especially just behind the shoulders, the fur is usually a little intermixed with grayish. Tail obscurely bicolor, brownish dorsally, paler ventrally. Dorsum of manus and pes Isabella color.

Skull.—The skull of *Sorex personatus* (Pl. VI, figs. 7, 8) is scarcely distinguishable from that of the European *Sorex minutus* (Pl. VI, fig. 6). As in the latter, the brain case is moderately high and rounded and the rostrum slender. The palatal depth at middle of molar series is less as compared with the cranial depth in all the members of the *minutus* group than in those of the *araneus* group. This is readily seen in comparison of the skulls of *S. personatus* and *S. richardsoni* (see table, page 43).

Teeth.—The teeth of *Sorex personatus* very closely resemble those of *S. minutus*, the only differences being in the relative size of the first premolar and in the form of the excavations on the posterior borders of the upper molariform teeth. The first premolar in *S. personatus* is minute and often scarcely visible from the outer side, while in *S. minutus* it is nearly as large as the canine. The deepest part of the excavations on the posterior borders of the upper molariform teeth is near the middle of the tooth in *S. minutus*, while in *S. personatus* it is carried farther toward the inner edge. The unworn unicuspid teeth of *S. personatus* (Pl. IV, figs. 1, 5, 6, and 7) vary considerably in form, pigmentation and relative size. The first, second, third, and fourth, however, diminish gradually in size, while the fifth is very small. The third incisor is usually slightly larger than the second, and distinctly larger than either the fourth incisor or the canine. The fourth incisor and the canine may be exactly the same size, or the latter slightly the smaller. The fourth incisor, however, is very rarely smaller than the canine (cf. *S. longirostris*). Occasionally the second incisor is the largest, the three succeeding teeth each slightly and uniformly smaller than the one before. Again, the second and third incisors may be equal and considerably larger than the fourth incisor or the canine, which in their turn are of approximately equal size.

The unicuspid teeth are usually about as broad as deep when viewed in profile (Pl. IV, figs. 5, 6, and 7). Occasionally, however, they are distinctly deeper than broad, and the whole row of unicuspids is a little shortened (Pl. IV, fig. 1). These differences appear to be in no way correlated with geographic distribution, specimens with the narrow, deep teeth occurring at Montauk Point, New York, Roan Mountain, North Carolina, and South Edmonton, Alberta. The cusps and ridges on the teeth of *Sorex personatus* are moderately tipped with light reddish brown. This brown tipping is variable both in extent and in depth of color (cf. fig. 1 with figs. 5, 6, and 7, Pl. IV). Like the variations in form of the unicuspid teeth, the character of the pigmentation is a purely individual matter.

Measurements.—Twelve adults from Nantucket Island, Massachusetts, average: Length, 100.8 mm.; tail vertebræ, 38.6 mm.; hind foot, 12.2 mm. Four specimens from North Truro, Mass., average: Length, 97.2 mm.; tail vertebræ, 37.2 mm.; hind foot, 11.35 mm. Two males from Mount Washington, New Hampshire (5,300 feet): Length, 105 mm.; tail vertebræ, 41 mm.; hind foot, 12.8 mm.; and, length, 106 mm.; tail vertebræ, 41.4 mm.; hind foot, 11.6 mm. Six specimens from Steele County, Minn., average: Length, 87.5 mm.; tail vertebræ, 33.5 mm.; hind foot, 11.1 mm. Two males from South Edmonton, Alberta, measure, respectively: Length, 94 mm.; tail vertebræ, 37 mm.; hind foot, 11 mm.; and length, 92 mm.; tail vertebræ, 36 mm.; hind foot, 11 mm.

General remarks.—Among the Shrews of the eastern United States *Sorex personatus* is distinguished by its small size from all but *S. longirostris* and *S. hoyi*. From both of these it differs so widely in cranial characters that no detailed comparison is needed.

In color average *Sorex personatus* are exactly like two English specimens of *S. minutus*, but I have seen too few skins of the latter to know whether this remarkable agreement is constant. *Sorex minutus* is readily distinguished from *S. personatus* by its very large fifth unicuspid tooth.

Sorex personatus varies considerably in color, winter specimens usually being darker and more strongly tinged with chestnut than those taken in midsummer. Sometimes there is a faint line of demarcation between the darker chestnut-tinged sepia of the back and the clear paler sepia of the sides, the latter again shading abruptly into the color of the belly. The color pattern so produced is similar to that of *S. araneus* and *S. richardsoni*, but is never so striking and well marked as in typical specimens of these animals. Individuals now and then occur with the whole pelage suffused with chestnut, but these are rare.

Specimens from the plains are paler than the average, but whether these represent a distinct local race it is at present impossible to say. Should the plains animal prove to be separable, it must take the name *haydeni* Baird.

Table of average cranial measurements and ratios.

Name.	Locality.	Number of specimens.	Greatest length exclusive of incisors.	Breadth of cranium.	Greatest anteorbital breadth.	Length of bony palate.	Ratio to total length.			Ratio of anteorbital breadth to palatal length.	Ratio of anteorbital breadth to cranial breadth.
							Of cranial breadth.	Of anteorbital breadth.	Of palatal length.		
Sorex hoyi	Elk River, Minn	8	14.4	6.5	4.1	5.2	45.14	28.47	36.09	78.84	61.69
Sorex palustris	do	4	20.4	10.6	6.7	8.4	52.2	33.09	40.93	80.95	63.38
Sorex albibarbis	Elizabethtown, N. Y.	3	20	10.3	6.26	8.3	51.5	31.3	41.3	75.79	60.77
Sorex araneus	New Forest, England	10	18.3	9.4	5.2	7.5	51.3	28.4	40.9	66.56	55.43
Sorex richardsoni	Elk River, Minn	10	18.4	9.5	5.3	7.6	51.79	28.18	41.24	69.65	55.46
Sorex fumeus	Peterboro, N. Y	6	17.3	8.9	5.1	6.9	51.76	29.47	39.88	73.91	52.02
	Elizabethtown, N. Y.	8	17.8	9.1	5.1	7	51.12	28.65	35.35	72.85	56.04
Sorex longirostris	Raleigh, N. C	4	14.7	7.5	4.4	5.6	51.02	27.21	38.09	78.65	58.66
Sorex personatus	Nantucket, Mass	10	15.2	7.8	4	6.1	51.31	26.31	41.31	64.61	51.28
	Elk River, Minn	8	15.3	7.7	4.3	6	49.9	27.5	39.42	71.26	55.7

NOTE.—The material on which *Sorex fisheri* Merriam from Dismal Swamp, Virginia (North American Fauna, No. 10, p. 86), is based came to hand too late for description in this paper. The teeth of a specimen at first supposed to be an unusually large *Sorex longirostris* are, however, figured in Plate IV.

SYNOPSIS OF THE AMERICAN SHREWS OF THE GENUS SOREX.

By C. Hart Merriam.

The object of the present paper is to furnish descriptions, on a common plan, of the principal types of American Shrews. Hence the multiplication of closely related forms has been avoided, and several fairly well marked subspecies have been allowed to go unnamed. Forty-one species and subspecies are here recognized, of which number 33 belong to the restricted genus *Sorex*, 1 to the subgenus *Microsorex*, 4 to the subgenus *Neosorex*, and 3 to the subgenus *Atophyrax*. The subgenera are restricted to the northern United States and Canada, while *Sorex* proper ranges from the Arctic Circle to Guatemala. The genus as a whole is clearly of boreal origin, and, excepting the austral *Sorex longirostris* and its relative *S. fisheri*, all of the southern forms are confined to high mountains.

The collection of mammals made by the Division of Ornithology and Mammalogy of the Department of Agriculture contains about 1,200 specimens of long-tailed Shrews (genus *Sorex*). In studying this material and mapping the geographic distribution of the various species, 20 new forms were discovered and are here described. Four of these are from Alaska, 1 from British Columbia, 4 from Mexico, and 11 from the United States.

All American Shrews have two pelages, which may be roughly designated as summer and winter coats, though by no means corresponding strictly with these seasonal limitations. As usual among small mammals, the molt takes place at different dates among individuals of the same species, so that it is not rare to capture specimens in different pelages on the same day. The winter pelage is usually plumbeous, dusky, or ash gray; the summer pelage sepia brown or chestnut. In some species, as *Sorex trowbridgii*, the change of color is slight and unimportant; in others, as *S. vagrans* and *S. personatus*, the difference is striking.

In defining the various species, cranial characters have proved serviceable and dental characters indispensable. The most useful cranial characters are the size and form of the brain case, breadth of the palate, length and degree of attenuation of the rostrum, and in some cases the breadth of the interorbital constriction. The most important dental characters are the size and depth of emargination of the molariform teeth and the proportions of the unicuspidate teeth.

In studying the skulls and teeth of Shrews it is absolutely essential to take into account changes due to age and wear. Old and young skulls of the same species from the same locality differ surprisingly in size, form, and massiveness. With increasing age the cranium as a whole becomes broader, shorter, and flatter, and in some species a low sagittal ridge is developed. The brain case and palate broaden measurably, and the arch of the brain case falls away. The molar teeth wear obliquely, so as to take on an appearance of greater breadth, and the long middle incisors not only wear off in front but turn down at a right angle to the cranial axis (see Pl. XI). Hence, in comparing skulls and teeth of related forms it is of the utmost importance to use specimens of approximately the same age.

Much labor has been expended upon the plates of Shrew teeth that accompany this paper, but they are not camera lucida drawings and can not be relied upon for small details.

List of American forms of Sorex, with type localities and number of specimens examined.

	Name.	Type locality.	No. of specimens.
1	*Sorex personatus*	Eastern United States (exact locality unknown).	235
2	*streatori* nob	Yakutat, Alaska	36
3	*obscurus*	Salmon River Mountains, Idaho	175
4	*ventralis* nob	Cerro San Felipe, Oaxaca, Mexico	21
5	*longicauda* nob	Wrangel, southeast Alaska	48
6	*alascensis* nob	Yakutat Bay, Alaska	27
7	*oreopolus*	Sierra Nevada de Colima, Jalisco, Mexico.	3
8	*richardsoni*	Probably plains of Saskatchewan, Canada.	114
9	*sphagnicola*	Fort Liard, British Columbia	2
10	*fumeus*	Peterboro, Madison County, N. Y	27
11	*vagrans*	Shoalwater Bay, Washington	104
12	*dobsoni*	Saw Tooth Mountains, Idaho	46
13	*monticola*	San Francisco Mountain, Arizona	9
14	*amœnus* nob	Mammoth Pass, Sierra Nevada, Calif	7
15	*vancouverensis* nob	Goldstream, Vancouver Island, B. C	1
16	*orizabœ* nob	Mount Orizaba, Puebla, Mexico	18
17	*nevadensis* nob	Reese River Valley, Nevada	4
18	*ornatus* nob	San Emigdio Canyon, Mount Piños, Calif.	7
19	*californicus* nob	Walnut Creek, Contra Costa County, Calif.	7
20	*tenellus* nob	Alabama Hills, Owens Valley, California.	3
21	*nanus* nob	Estes Park, Colorado	4
22	*pribilofensis* nob	St. Paul Id., Pribilof Islands, Bering Sea.	5
23	*merriami*	Fort Custer, Mont	1
24	*bairdi* nob	Astoria, Oreg	9
25	*trowbridgii*	do	19
26	*montereyensis* nob	Monterey, Calif	33
27	*macrodon* nob	Orizaba, Vera Cruz, Mexico	10
28	*verœpacis*	Coban, Guatemala	5
29	*saussurei*	Sierra Nevada de Colima, Jalisco, Mexico.	24
30	*caudatus* nob	Reyes, Oaxaca, Mexico	41
31	*longirostris*	Santee river, South Carolina	3
32	*fisheri* nob	Dismal Swamp, Virginia	5
33	*pacificus*	Mouth of Umpqua River, Oregon	13
	Subgenus *Microsorex:*		
34	*hoyi*	Racine, Wis	23
	Subgenus *Neosorex:*		
35	*palustris*	Between Hudson Bay and Rocky Mts	9
36	*navigator*	Probably northern Idaho[1]	77
37	*albibarbis*	Profile Lake, Franconia Mountains, N. H.	5
38	*hydrodromus*	Unalaska Id., Aleutian Islands, Alaska.	....
	Subgenus *Atophyrax:*		
39	*bendirii*	Klamath Basin, Oregon	21
40	*palmeri* nob	Astoria, Oreg	3
41	*albiventer* nob	Olympic Mountains, Washington	3

---

[1] See page 92, footnote.

KEY TO SPECIES OF SOREX PROPER.

A. *Species living north of Mexico.*

- Size very large (total length about 150 mm.; hind foot, 17 mm.) .... *pacificus*
- Size medium or small (total length never more than 135 mm.; hind foot, 15.5 mm. or less).
  - Third unicuspid larger than fourth.
    - Size rather large (head and body about 70 mm.).
      - Coloration distinctly tricolor (sides different from back).
        - Hind foot about 14 mm.; tail about 40 mm.; skull, 20 mm ..... *richardsoni*
        - Hind foot about 13 mm.; tail about 35 mm.; skull, 16 mm..... *pribilofensis*
      - Coloration bicolor (sides same color as back).
        - Color plumbeous or sepia brown; pelage normal .... *fumeus*
        - Color almost sooty black; pelage exceedingly long............. *sphagnicola*
    - Size rather small (head and body about 60 mm.).
      - Skull short and broad; unicuspids on same plane with molars...... *merriami*
      - Skull long and narrow; unicuspid series strongly deflected, forming angle with molar series.
        - Tail about 40 mm. or less.................................... *personatus*
        - Tail 45 mm. or more.. *streatori*
  - Third unicuspid smaller than fourth.
    - Hind foot about 15 mm.
      - Anterior unicuspids much swollen................................ *bairdi*
      - Anterior unicuspids not much swollen.
        - Color dark plumbeous or sooty............................. *montereyensis*
        - Color dull chestnut brown, varying to sepia brown.
          - Tail very long (about 60 mm.)........................... *longicauda*
          - Tail medium (about 50 mm.)............................. *alascensis*
    - Hind foot about 14 mm. or less.
      - Hind foot about 14 mm. (color dark plumbeous or sooty).......... *trowbridgii*
      - Hind foot about 13 mm. or less.
        - Sides pale; rump with a dark patch; molariform teeth broadly and deeply excavated posteriorly .... *ornatus*
        - Coloration normal; excavation of molariform teeth moderate.
          - Hind foot about 13 mm.
            - Tail less than 45 mm..................................... *dobsoni*
            - Tail more than 45 mm.................................... *obscurus*
          - Hind foot decidedly less than 13 mm.
            - Brain case low and flat.
              - Brain case broadly rounded .... *californicus*
              - Brain case narrow.
                - Hind foot more than 12 mm.......................... *tenellus*
                - Hind foot about 10 mm............................. *nanus*
            - Brain case normal.
              - Total length less than 100 mm.
                - Coloration tricolor; sides much paler than back......... *nevadensis*
                - Coloration normal; sides not paler than back.
                  - Hind foot less than 11 mm.................... *longirostris*
                  - Hind foot 12 mm or more.......................... *fisheri*
              - Total length more than 100 mm.
                - Tail less than 40 mm.; color dusky or sooty............. *amœnus*
                - Tail more than 40 mm.
                  - Color pale sepia brown....................... *monticola*
                  - Color dark.
                    - Back and sides dark brown, varying to almost russet.. *vagrans*
                    - Back almost dusky; sides sepia brown........... *vancouverensis*

B. *Species living in southern Mexico and Guatemala.*

- Size rather large (total length 118 mm. or more).
  - Hind foot 15 mm. or more.
    - Color nearly black; under parts hardly paler .... *veræpacis* p. 82
    - Color mixed sepia and black; under parts seal brown .... *macrodon* p. 82
  - Hind foot less than 15 mm.
    - Tail very long (55 mm. or more) .... Saussurei *caudatus* p. 84
    - Tail moderate (50 mm. or less) .... *saussurei* p. 83
- Size rather small (total length about 105 mm. or less).
  - Belly pale .... *orizabæ* p. 71
  - Belly dark.
    - Under parts dull chestnut .... obscurus *ventralis* p. 75
    - Under parts drab .... *oreopolus* p. 77

SOREX PERSONATUS Geoffroy Saint Hilaire.

(Pl. VII, figs. 5, 5*a*; Pl. IX, figs. 7, 7*a*.)

Sorex personatus Geoffroy Saint Hilaire, Mém. du Muséum, Paris, XV, 122–125, 1827. (From United States.)

Sorex forsteri Richardson, Zool. Jour., III, 516–517, January to April, 1828. (From the fur countries.)

Sorex cooperi Bachman, Jour. Acad. Nat. Sci. Phila., VII, 388, Pl. XXIV, fig. 7, 1837. (Probably from northern part of Mississippi Valley.)

Amphisorex lesueuri Duvernoy, Mag. Zool., 2ᵉ ser., IV, Mamm., 33–34, Pl. L, 1842. (From Wabash River, Indiana.)

Sorex platyrhinchus Linsley, Silliman's Am. Jour. Sci., XLIII, 346–347, October, 1842. (From Stratford, Conn.)

Otisorex platyrhinus De Kay, Zool. New York, Mammalia, 22, Pl. V, fig. 1, 1842. (From Tappan, Rockland County, N. Y.)

Sorex platyrhinus Baird, Mammals N. Am., 25–26, Pl. XXVIII, 1857.

Sorex haydeni Baird, Mammals N. Am., 29–30, Pl. XXVII, 1857. (From Fort Union, now Fort Buford, N. Dak.)

Sorex idahoensis Merriam, N. Am. Fauna, No. 5, pp. 32–33, Pl. IV, fig. 1, August, 1891. (From Salmon River Mountains, Idaho.)

Type locality.—Eastern United States.

Geographic distribution.—Boreal and Transition zones of North America from New England to Alaska, except the southern Rocky Mountains and the Cascade-Sierra systems; south in the higher Alleghenies to Tennessee and North Carolina.

General characters.—Size small (total length, about 100 mm.; hind foot, about 12 mm.); tail shorter than body without head; coloration dark; skull and palate narrow; unicuspid series gradually diminishing (third tooth not normally smaller than fourth).

Color.—Upper parts sepia brown, very finely (and usually inconspicuously) mixed with dark-tipped hairs; under parts ashy gray; tail bicolor: upper side and tip all round dusky, under side dull whitish. A chestnut pelage or phase occurs, but is rare. Out of 20 specimens from Roan Mountain, North Carolina, only 2 are chestnut; both were collected in September.

Cranial and dental characters.—Skull small, rather slender; palate narrow and arched; anterior part of rostrum compressed and attenuate; unicuspids decreasing in size from first to fifth. (Viewed from the side they are sometimes in pairs, first and second subequal and third and fourth subequal.) Specimens from the northern plains have the anterior part of the rostrum slightly more attenuate, with the unicuspidate series nearer together and more nearly parallel. The unicuspid teeth also are more crowded, more vertical, less imbricating, and somewhat more heavily pigmented. This form was named *forsteri* by Richardson, but the characters are inconstant and are matched by some specimens from the east, notably from Montauk Point, Long Island, New York.

Measurements.—Average of 8 specimens from Montauk Point, Long Island, New York: Total length, 98.3 mm.; tail vertebræ, 38 mm.; hind foot, 12 mm. Average of 4 from Roan Mountain, North Carolina: Total length, 100.5 mm.; tail vertebræ, 41 mm.; hind foot, 12.3 mm. (For table of measurements see p. 63.)

General remarks.—*Sorex personatus*, the common Shrew of the eastern United States, has a larger area of distribution than any other American species, stretching all the way across the continent from New England to Alaska. Throughout this wide range its variations are surprisingly slight. Certain inconstant departures have been already mentioned under the skull characters. In coloration also there are geographic differences. The most marked of these is a pale form from the prairies and plains of the Dakotas. In this animal the whitish of the under parts reaches far up over the sides, and is bordered above by a band of buffy, restricting the dark color of the back to a dorsal band. This tricolor pattern is well shown in a specimen from Portland, N. Dak. (No. 36854, U. S. Nat. Mus.), collected October 26, 1892, by J. Alden Loring. This form was separated by Baird, under the name *S. haydeni*, and is probably entitled to recognition. Another form that will probably require separation comes from the extreme southern limit of range of the species, where it overlaps from the Transition into the Upper Austral or Carolinian zone. If worthy of recognition, it will probably take the name *lesueuri*, proposed by Duvernoy in 1842 for a specimen from Wabash Valley, Indiana. Specimens of this form are extremely rare, and have been examined from only two localities—Sandy Spring, Md., and New Harmony, Ind.[1]

Specimens of *S. personatus* from the Rocky Mountains, near the eastern boundary of British Columbia (Field and Glacier), are noticeably larger and have larger skulls than those from the neighboring plains on the east, in which respect they tend toward subspecies *streatori* of southeastern Alaska.

---

[1] Unfortunately, the skull of the specimen from New Harmony can not be found.

Respecting the pertinence of the name *personatus* for this Shrew, Dr. G. E. Dobson wrote me from Netley, England, under date of October 5, 1885, as follows:

> I have lately returned from Paris, where I have been studying the Soricidæ in the Museum of the Jardin des Plantes. I have found there the type of *Sorex personatus* Geoff., which is certainly = *S. cooperi*, the latter name becoming, therefore, a synonym.

Specimens examined.—Total number, 235, from the following localities:

Province of Quebec, Canada: Godbout, 30.
New Brunswick: St. John, 1.
Maine: South West Harbor, 2.
New Hampshire: Ossipee, 1.
Massachusetts: Wilmington, 2.
New York: Adirondacks, 2; Locust Grove, 7; Montauk Point, 8; Amityville (Long Island), 1.
Pennsylvania: Drury Run, 3.
New Jersey: Tuckerton, 5.
North Carolina: Roan Mountain, 20.
Indiana: New Harmony, 1; North Manchester, 1.
Michigan: Ann Arbor, 4.
Minnesota: Elk River, 64; Minneapolis, 12; Tower (Vermillion Lake), 1; Hinckley, 2; Browns Valley, 1.
Ontario: Rat Portage, 1; Ottawa, 1; Parry Sound, 4; Sand Lake, 3.
Manitoba: Carberry, 6.
Assiniboia: Indian Head, 4.
Alberta: South Edmonton, 2; St. Albert, 1; Island Lake, 1; Banff, 2; Canmore, 1.
British Columbia: Glacier, 6; Field, 3; Kamloops (Cariboo Lake), 1; Sicamous, 1; Mount Baker Range, 1.
Washington: Head of Lake Chelan, 1.
Montana: Fort Custer, 8; Dry Creek, 1; St. Marys Lake, 3.
Idaho: Salmon River Mountains, 4; Saw Tooth Lake, 2.
Wyoming: Big Horn Mountains, 1.
North Dakota: Portland, 2; Steele, 1; Grank Forks, 1; Bottineau, Turtle Mountain, 1.
South Dakota: Black Hills, Custer, 2; Deadwood, 1; Vermillion, 1

SOREX PERSONATUS STREATORI subsp. nov.

Type from Yakutat, Alaska (about latitude 59° 35′). Type, No. 73537, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected July 9, 1895, by C. P. Streator. Original number, 4674.

General characters.—Similar to *S. personatus*, but larger and darker (total length, 106.6 mm.; hind foot, 12.7 mm.); tail nearly equal to body without head.

Color.—Upper parts finely mixed sepia brown and dusky, the dusky strongest on posterior half of back and nearly absent on sides; under parts ash gray; tail sharply bicolor: dusky above and all round at tip, whitish below.

Cranial and dental characters.—Skull and teeth as in *personatus*, but skull averaging slightly longer.

Measurements.—Type specimen: Total length, 107 mm.; tail vertebræ, 50 mm.; hind foot, 12.5 mm. Average of 8 specimens from type locality (Yakutat Bay, Alaska): Total length, 106.6 mm.; tail vertebræ, 45.6 mm.; hind foot, 12.7 mm.

General remarks.—The slight change that *Sorex personatus* undergoes in crossing the continent from the Atlantic to the Pacific is surprising. Skulls from Montauk Point, Long Island, New York, are hardly distinguishable from those from Yakutat Bay, Alaska, except that the latter are somewhat larger. Externally, the difference is a little more marked; there is a slight increase in size and in length of tail, and a decided darkening of the color of the upper parts as a whole.

Specimens examined.—Total number, 36, from the following localities in southeastern Alaska: Yakutat, 8; Sitka, 16; Wrangel, 7; Loring, Revillagigedo Island, 5.

Mean measurements of Sorex personatus and S. p. streatori from different localities.

	Total length.	Tail.	Hind foot.	No. of specimens in average.
Sorex personatus:				
Ann Arbor, Mich	94.5	35.3	11.3	4
Drury Run, Clinton County, Pa	96	39.3	11.7	3
Tuckerton, N. J	98.6	40.6	12.8	5
Montauk Point, New York	98.3	38	12.1	8
Hinckley, Minn	98	39.5	12.5	2
Wilmington, Mass	100	40.5	12	2
Godbout, Quebec, Canada	100	41	12	15
Roan Mountain, North Carolina	100.5	41	12.3	4
Glacier, British Columbia*	106.4	42.2	12.8	5
Salmon River Mountains, Idaho†	95.7	40	11.7	4
South Edmonton, Alberta‡	93	36.5	11	2
S. personatus streatori:				
Yakutat, Alaska (type locality)	106.6	45.6	12.7	8
Sitka, Alaska	108.1	46.9	13.4	15
Wrangel, Alaska	108.1	45.5	13.2	7
Loring, Alaska	105	46	13	4

* Inclining toward *streatori*. † Type locality of '*idahoensis*.' ‡ Typical of '*forsteri*.'

SOREX RICHARDSONI Bach.

(Pl. IX, figs. 1, 1*a*.)

Sorex parvus Richardson, Fauna Boreali-Americana, 8, 1829 (Not *S. parvus* Say, 1823).
Sorex richardsonii Bachman, Jour. Acad. Nat. Sci. Phila., VII, 383, Pl. XXIV, fig. 5, 1837.

Type locality.—Unknown; probably plains of Saskatchewan.

Geographic distribution.—Plains of Saskatchewan and boreal parts of Minnesota; limits of range unknown.

General characters.—Size large (hind foot, 14 mm.); tail short; animal tricolor.

Color.—Upper parts uniform dull dark brown (almost seal brown in some specimens), without plumbeous tinge, and free from admixture of hoary or pale-tipped hairs; sides dull fulvous or ochraceous, in strong contrast; under parts dark plumbeous washed with chestnut; tail dusky above and all round at tip, pale brownish below on basal two-thirds. In one pelage the colors are duller, the under parts brownish and the side stripe indistinct. Minnesota specimens have the side stripe buffy ash or with the faintest possible tinge of fulvous, and the belly ash gray.

Cranial and dental characters.—Skull similar to that of *fumeus*, but slightly larger (20 mm. by 9.3 mm.); rostrum and brain case higher; constriction higher and narrower; anterior part of rostrum longer and more pinched in laterally, making the unicuspid series more nearly parallel; interpterygoid fossa narrower; anterior opening of infraorbital canal smaller and situate far forward, over front of m^1; lachrymal canal opening over middle of m^1 instead of over interspace between m^1 and m^2, as in *fumeus;* molariform teeth much less deeply excavated posteriorly; unicuspidate teeth very much heavier and more swollen, and lacking the distinct vertical ridge on inner side.

Measurements.—Average of 25 specimens from South Edmonton, Alberta (assumed to be near the type locality): Total length, 113.2 mm.; tail vertebræ, 40.4 mm.; hind foot, 13.9 mm. Average of 3 from Wingard, Saskatchewan (near Carlton House): Total length, 112.7 mm.; tail vertebræ, 41.3 mm.; hind foot, 14 mm.

General remarks.—This large saddle-back Shrew hardly requires comparison with any other species, though specimens in the dull pelage sometimes resemble the brown pelage of *S. fumeus.* The two may always be distinguished by the cranial characters above given.

Specimens examined.—Total number, 114, from the following localities:

Manitoba: Carberry, 2.
Alberta: South Edmonton, 25; St. Albert, 31; Island Lake, near Lake St. Ann, 3.
Assiniboia: Indian Head, 1.
Saskatchewan: Wingard, 4.
Minnesota: Bridgman, 1; Elk River, 44; Minneapolis, 3.

SOREX SPHAGNICOLA Coues.

Sorex sphagnicola Coues, Precursory Notes American Insectivorous Mammals, Bull. U. S. Geol. and Geog. Surv., Vol. III, p. 650, May 15, 1887.

Sorex belli Dobson MS., 1885; Merriam, Proc. Biol. Soc. Wash., VII, 25, 1892 (*nomen nudum*).

Type locality.—Vicinity of Fort Liard, British Columbia (about latitude 60°).

Geographic distribution.—Sub-Arctic America from extreme northern British Columbia (and probably Alaska) to Hudson Bay.

General characters.—Size medium (hind foot 13.5 mm.); tail decidedly shorter than body without head; unicuspids large and gradually diminishing (fourth smaller than third); fur remarkably long and full (9 mm. on back); tail large, of uniform diameter from base to tip, and densely haired; no fringe on feet; claws conspicuous.

Color.—Upper parts rich, dark seal-brown, almost sooty black, darkest on rump and palest on head; color of upper parts extending well down on sides, leaving a rather narrow strip of grayish brown along the belly from chin to root of tail; color of upper parts rather abruptly different from that of belly; tail concolor, same color as rump.

Dental characters.—Unicuspids large and strongly imbricating; first and second subequal; third smaller but decidedly larger than fourth. Viewed from below, unicuspids 1 to 4 are subquadrate in outline.

Measurements (from dry skin, probably too short).—Total length, 110 mm.; tail vertebræ, 42 mm.; pencil, 6 mm.; hind foot, 13.5 mm.

General remarks.—The above description and measurements were taken by me from a specimen collected by Dr. Robert Bell on Shamattawa River, a tributary of Hayes River, Hudson Bay, and now in the Museum of the Geological and Natural History Survey of Canada, at Ottawa. The specimen was compared with the type of *S. sphagnicola*, in the United States National Museum, by Mr. F. W. True, Gerrit S. Miller, jr., and myself. The type specimen of *sphagnicola* is in very bad condition, but we were unable to discover any character by which the Hayes River specimen could be separated from it. The only apparent difference is in the hairs of the under side of the tail, which in the worn specimen are much shorter and stiffer, like bristles. Precisely this difference may be seen in a series of *Sorex richardsoni* from South Edmonton, Alberta, and is evidently the result of wear.

Sorex sphagnicola seems to be closely related to *S. richardsoni*, from which it may be distinguished by the color of the sides. In *sphagnicola* the sooty black of the upper parts reaches down over the sides and encroaches on the belly; in *richardsoni* the sides are buffy or pale fulvous, in sharp contrast with the color of the back.

Dr. Bell's specimen from Hayes River, Hudson Bay, on which the above description is based, was named *Sorex belli* by Dobson in 1885, but his description was never published. Dr. Dobson suspected its identity with *S. sphagnicola*, and suggested that the type specimens be compared, which has been done, with the result above stated. Dr. Bell's specimen "was the 'totem' of an Indian chief from whom it was stolen, and when he missed it he went on the war path."

SOREX FUMEUS Miller.

(Pl. IX, figs. 2, 2*a*.)

Sorex platyrhinus Dobson, Monog. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 5, May, 1890.

Sorex fumeus Miller, N. Am. Fauna, No. 10, December, 1895, pp. 50–52.

Type locality.—Peterboro, Madison County, N. Y.

Geographic distribution.—Canadian and upper part of Transition faunas of eastern United States; southward in higher Alleghenies to mountains of North Carolina and Tennessee.

General characters.—Size rather large (hind foot, 13 mm.); tail rather short; ears prominent; animal nearly concolor.

Color.—Plumbeous pelage: Upper parts dark slate color, becoming gradually paler below; under parts plumbeous, more or less washed with grayish ash; tail bicolor: dusky above, flesh color below; feet flesh color. Brown pelage: Everywhere dull chestnut brown, paler below; tail and feet as in other pelage.

Cranial and dental characters.—Skull similar to that of *S. richardsoni*, but averaging slightly smaller; rostrum and brain case lower; constriction flatter and broader; interpterygoid notch slightly broader; anterior opening of infraorbital canal large and covering nearly whole of m^1; opening of lachrymal canal over interspace between m^1 and m^2 (instead of over middle of m^1, as in *richardsoni*). Molariform teeth much more deeply excavated; unicuspids very much smaller and less swollen, but with a well developed vertical ridge on inner side.

Measurements.—Average of 6 specimens from Peterboro, N. Y. (type locality): Total length, 116 mm.; tail vertebræ, 45.4 mm.; hind foot, 13.2 mm. Average of 4 specimens from Renovo, Pa.: Total length, 108.5 mm.; tail vertebræ, 43.5 mm.; hind foot, 12.3 mm. Average of 3 specimens from Lake George, N. Y.: Total length, 118.7 mm.; tail vertebræ, 47 mm.; hind foot, 13 mm.

General remarks.—*Sorex fumeus* is the larger and more boreal of the two species of *Sorex* inhabiting the northeastern United States and the higher Alleghenies farther south. It does not require close comparison with any other species. Specimens from the Adirondacks, the mountains of New England, and Roan Mountain, North Carolina, are larger and have higher brain cases than the typical form from central New York (Peterboro) and Pennsylvania (Renovo). The two pelages in this species are very different and are clearly seasonal—the plumbeous is the winter coat, the brown the summer. This is well shown in a series of 18 specimens from Roan Mountain, on the boundary between North Carolina and Tennessee. Eight of these are in the plumbeous pelage, and were collected from October 11 to May 3; and ten are in the chestnut-brown pelage, and were collected from June 2 to September 11.

Sorex fumeus of the northeastern States resembles *S. trowbridgii* of the Pacific coast of Oregon and Washington in many respects. In color both are plumbeous or dark slate, in which particular they differ from all other members of the genus inhabiting the United States. Their skulls and teeth also are very much alike, though *S. trowbridgii* has the small third unicuspid characteristic of most west American Shrews. The skull of *fumeus* is somewhat the larger, but the tooth rows are of approximately the same length. The molars are essentially the same in both, but the premolar and unicuspids are materially larger in *fumeus*—the premolar larger in every way and the unicuspids broader. The last upper molar, on the other hand, is largest in *trowbridgii*. In *fumeus* the large premolar is much more deeply excavated posteriorly.

Specimens examined.—Total number, 27, from the following localities:

New York: Peterboro (type locality), 1; Lake George, 3.
New Hampshire: Ossipee, 1.
Pennsylvania: Renovo, 4.
North Carolina: Roan Mountain, 18.

SOREX VAGRANS Baird.

(Pl. VIII, figs. 2, 2*a*.)

Sorex vagrans Baird, Mammals N. Am., pp. 15-18, Pl. XXVI, fig. 1675, 1857. (Type from Shoalwater Bay, Washington.)

Sorex suckleyi Baird, Mammals N. Am., pp. 18-20, Pl. XXVII, fig. 1677, 1857. (Type from Steilacoom, Washington.)

Type locality.—Shoalwater Bay, Washington.

Geographic distribution.—Southern British Columbia, western Washington and Oregon, and northern California (south on the coast to Monterey and in the mountains to old Fort Crook and Cassel). Restricted to lower Boreal and upper Transition zones.

General characters.—Size small; tail medium, about equaling body without head; third unicuspid smaller than fourth.

Color.—Upper parts dark brown, varying to almost russet; under parts ashy; tail dusky above, pale below.

Cranial and dental characters.—Skull normal, presenting no marked peculiarities, and measuring about 17 mm. in greatest length (including unworn middle incisors) by 8 mm. in greatest breadth, thus being the smallest of the northwest coast Shrews. Interpterygoid fossa rather broad and short. Compared with the skull of *S. obscurus*, which it resembles closely, it averages about 1 mm. shorter, while the breadth of the brain case remains essentially the same. The upper molars and large upper premolar are decidedly smaller than in *obscurus* and this character affords the best means of distinguishing the two species.

Measurements.—Average of 20 specimens from Aberdeen, Wash.: Total length, 103 mm.; tail vertebræ, 43 mm.; hind foot, 12.3 mm.

General remarks.—*Sorex vagrans* is the common small Shrew of the northwestern coast region of the United States and southern British Columbia. In some localities it occurs with the slightly larger *S. obscurus*, from which it is not easily distinguished except by actual comparison of the molariform teeth. It is less boreal than *obscurus*, inhabiting the upper part of the Transition and lower part of the Boreal zones, while *obscurus* is exclusively boreal. In the Rocky Mountain region *Sorex vagrans* is represented by *S. dobsoni*, with which it apparently intergrades, as specimens from eastern Washington (Marshall and Wawawai) seem to be intermediate between the two.

Sorex suckleyi Baird is identical with *S. vagrans*, as I have determined by comparison of the type specimens. In describing *suckleyi* as distinct Baird was misled by an immature and defective skull (No. $\frac{1276}{362}$, U. S. Nat. Mus.). The base of this skull is broken and foreshortened, causing the brain case to bulge laterally, and all the anterior teeth are absent, so that the skull has an abnormal appearance (roughly shown on Pl. XXVII, Hist. N. Am. Mammals). Baird's other specimen from the type locality (No. 1677, Steilacoom) is alcoholic, and its skull is normal and identical with the type of *vagrans*, and also with other specimens of *vagrans* in the Department collection from Steilacoom. Baird's alcoholic cotype (No. 1677) agrees with typical *vagrans* in size. It now measures: Total length, 95 mm.; tail vertebræ, 43.5 mm.; hind foot, 12 mm.

Specimens examined.—Total number, 104, from the following localities:

British Columbia: Port Moody, 4; Sumas, 1; Mount Baker Range, 1.

Washington: Steilacoom, 4; Olympic Mountains (Lake Cushman), 11; Sauk, 1; Mount Vernon, 1; Hamilton, 1; Avon, 3; Aberdeen, 22; Shoalwater Bay, 1; Easton, 3; Marshall, 7; Wawawai (5 miles northeast), 1.

Oregon: Salem, 8; Oregon City, 2; Sheridan, 2; Gold Beach, 3; Port Orford, 1; Florence, 1; Fort Klamath, 4.

California: Crescent City, 3; San Mateo, 1; Monterey, 1; Fort Crook, 10 (inclining toward *amœnus*); Cassel, 2; Carberry ranch, 5 (intergrade with *amœnus*).

SOREX VAGRANS DOBSONI Merriam.

(Pl. IX, figs. 8, 8*a*.)

Sorex dobsoni Merriam, N. Am. Fauna, No. 5, pp. 33-34, Pl. IV, fig. 2, August, 1891. Type from Saw Tooth or Alturas Lake, east base Saw Tooth Mountains, Idaho.

Geographic distribution.—Rocky Mountain region in northern Idaho and western Montana; also isolated mountains in Montana (Big Snowy and Pryor mountains), Wyoming (Big Horn Mts.), and Utah (Wasatch Mts.). Restricted to lower Boreal and upper Transition zones.

General characters.—Intermediate in size and cranial characters between *S. vagrans* and *obscurus;* third unicuspid smaller than fourth.

Color.—Upper parts uniform dull sepia brown with a faint chestnut tinge; under parts ashy gray washed with drab; tail bicolor: dark brown above, drab below. In winter pelage the upper parts are iron gray or ash gray with very little sepia, and the under parts are white or nearly white.

Cranial and dental characters.—Skull and teeth similar to those of *S. obscurus*, but skull slightly smaller; palate narrower; anterior part of rostrum more attenuate; unicuspid series decidedly narrower, especially the first and second teeth. Compared with *S. vagrans* the skull is larger, particularly the brain case; the molariform teeth also are larger.

Measurements.—Type specimen: Total length, 105 mm.; tail vertebræ, 47 mm.; hind foot, 12.5 mm. Average of 7 specimens from type locality (east base of Saw Tooth Mountains, Idaho): Total length, 104 mm.; tail vertebræ, 43.4 mm.; hind foot, 12.8 mm.

General remarks.—*Sorex dobsoni* is the interior form of *S. vagrans;* it inhabits the Rocky Mountain plateau, while true *vagrans* is confined to the coast region and Cascade-Sierra system. Intermediate specimens have been examined from Marshall and Wawawai on the elevated sage plain of eastern Washington. Skulls of *dobsoni* from the Big Horn Mountains have the brain case flatter (more depressed posteriorly) than those from the adjacent Pryor Mountains. The latter agree with specimens from the Big Snowy Mountains in having the brain case high posteriorly and the teeth heavily pigmented. The interrelations of *dobsoni* and *obscurus* are intricate and perplexing. The two animals resemble one another very closely, but no intergrades have been found, and each has, so far as known, an independent distribution. They are best distinguished by the size of the teeth, the measurements of which are given under *S. obscurus* (p. 72). In the type specimen the third unicuspidate tooth is abnormally large.

Specimens examined.—Total number, 46, from the following localities:

Idaho: Alturas Lake (type locality), 7; Mullan, 2; Osburn, 1; Cœur d'Alene, 2; Seven Devils Mountains, 1.

Montana: Pryor Mountains, 5; Big Snowy Mountains, 4; Tobacco Plains, 1; Flathead Lake, 6; Nyack, 1; Summit (Great Northern Railroad), 2; Prospect Creek, near Thompson, 3; Thompson Pass, 2.

Wyoming: Bighorn Mountains, 4; Le Barge Creek (Wyoming Range), 1.

Utah: Ogden, 4.

SOREX VAGRANS MONTICOLA Merriam.

Sorex monticolus Merriam, N. Am. Fauna, No. 3, 43–44, September 11, 1890.

Type locality.—San Francisco Mountain, Arizona (altitude, 3,500 meters—11,500 feet).

General characters.—Size, small; pelage short; third unicuspid much smaller than fourth. Similar to *S. vagrans* in size and general appearance, but color grayish brown instead of chestnut brown; teeth broader.

Color.—Upper parts pale sepia brown without chestnut tinge, under parts ashy gray; tail bicolor: brownish above, whitish beneath except near tip, which is dark all round.

Cranial and dental characters.—Skull similar to that of *vagrans*, but slightly shorter (the shortening postrostral); palate and constriction between brain case and rostrum broader; unicuspids and molariform series broader.

Measurements.—Average of 4 specimens from type locality: Total length, 108 mm.; tail vertebræ, 44.2 mm.; hind foot, 12.7 mm. Average of 4 from Chiricahua Mountains, Arizona: Total length, 110 mm.; tail vertebræ, 47.5 mm.; hind foot, 12.2 mm.

General remarks.—*Sorex monticola* is only a slightly differentiated form of *vagrans*. It is known only from the mountains of Arizona, but is likely to be found in those of northern Mexico also.

Specimens examined.—Total number, 9, from the following localities in Arizona: San Francisco Mountain (type locality), 4; Springerville, 1; Chiricahua Mountains, 4.

SOREX AMŒNUS sp. nov.

Type from Mammoth Pass, head of Owens River, east slope Sierra Nevada, California (altitude, about 10,000 feet). Type, No. $\frac{29784}{41863}$, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected July 22, 1891, by E. W. Nelson. Original number, 1129.

General characters.—Similar in general to *S. vagrans*, but larger; tail shorter; color widely different: sooty instead of dull chestnut brown.

Color.—Upper parts dark fuliginous or dusky, faintly grizzled with brownish; sides pale dull brownish; under parts buffy whitish; tail blackish above, whitish below, becoming darker toward the tip. There is no trace of plumbeous in the fuliginous of the back, which is finely grizzled by a slight admixture of brownish hairs similar to those of the sides. The two specimens from the type locality are distinctly tricolor, though less markedly so than *S. richardsoni*, to which very different species *amœnus* bears a superficial likeness.

Cranial and dental characters.—As in *S. vagrans.*

Measurements.—Average of 2 specimens from type locality: Total length, 103 mm.; tail vertebræ, 37 mm.; hind foot, 12.3 mm. Average of 5 specimens from Carberry ranch, near summit of Sierra Nevada, Shasta County, Calif.: Total length, 104 mm.; tail vertebræ, 39 mm.; hind foot, 12.3 mm.

General remarks.—This handsome Shrew may be known at a glance by its short tail and peculiar color. This color may be in part seasonal, as specimens from a point farther north in the Sierra Nevada (Carberry ranch) vary from nearly as dark as typical *amœnus* to ashy brown. Intergradation with *vagrans* may occur in northern California or southern Oregon. A female caught by Mr. Nelson at the type locality July 22, 1891, contained 9 embryos.

SOREX VANCOUVERENSIS sp. nov.

Type from Goldstream, Vancouver Island, British Columbia. Type, No. 71913, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected May 10, 1895, by Clark P. Streator. Original number, 4592.

General characters.—Similar to *S. vagrans*, but larger, with decidedly larger forefeet and much darker coloration.

Color.—Upper parts finely mixed dusky and sepia brown, the dusky prevailing on the back, the sepia brown on the sides, where it forms an indistinct band; under parts plumbeous, lightly tipped with ash and irregularly washed (in type specimen) with rusty, which may be due to staining. Tail very dark brown, becoming almost dusky all round near tip; paler below on basal half.

Cranial and dental characters.—Skull and teeth similar to those of *S. vagrans;* molariform teeth a little smaller, though the difference is slight.

Measurements (of type specimen, in flesh).—Total length, 110 mm.; tail vertebræ, 43 mm.; hind foot, 12 mm.

General remarks.—In external appearance *Sorex vancouverensis* differs conspicuously from its nearest relative, *S. vagrans*, being of a very different color and having larger feet; but in cranial and dental characters the two are practically indistinguishable.

SOREX ORIZABÆ sp. nov.

Type from Mount Orizaba, State of Puebla, Mexico (altitude, 9,500 feet). Type, No. 53633, ♀ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected April 24, 1893, by E. W. Nelson. Original number, 4733.

General characters.—Size small; tail short; ears conspicuous; hind foot, 13 mm. Similar to *S. vagrans* and *monticola*, but tail shorter, coloration darker, pelage longer, with numerous long hairs on rump; molariform teeth smaller.

Color.—Upper parts finely mixed sepia brown and dusky (no chestnut tinge), darkest on posterior half of back; under parts ashy gray, sometimes faintly washed with brownish; tail bicolor: dark brown above, whitish beneath, with line of demarcation usually distinct.

Cranial and dental characters.—Skull hardly distinguishable from that of *S. monticola* (from Arizona), but molariform teeth smaller and anterior unicuspids narrower, having much less of the ridge on inner side that is so prominent in *monticola* and *vagrans.*

Measurements.—Type specimen: Total length, 103 mm.; tail vertebræ, 38 mm.; hind foot, 13 mm. Average of 7 specimens from type locality (Mount Orizaba): Total length, 99.6 mm.; tail vertebræ, 35.4 mm.; hind foot, 13 mm.

General remarks.—*Sorex orizabæ* is the smallest Shrew thus far discovered in Mexico. It is also the only one with a light belly. It belongs to the *vagrans* group, and is very closely related to *S. monticola* of the mountains of Arizona.

Specimens examined.—Total number, 18, from the following localities in southern Mexico: Mount Orizaba, Puebla (type locality), 7; Mount Malinche, Tlaxcala, 2; Cofre de Perote, Vera Cruz, 1; Salazar, Mexico, 2; north slope Volcan Toluca, Mexico, 3; Nahuatzin, Michoacan, 3.

SOREX NEVADENSIS sp. nov.

Type from Reese River, Nevada. Type, No. $\frac{24891}{32302}$, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected November 24, 1890, by Vernon Bailey. Original number, 2150.

General characters.—Size small; tail shorter than body without head; hind foot, about 12.5 mm.; coloration peculiar, indistinctly tricolor. Similar in general to *S. vagrans*, but tail shorter and color very different.

Color.—Upper parts finely mixed slate black and hoary; sides indistinctly buffy or very pale brownish fulvous; under parts hoary, without sharp line of demarcation. Ears brownish; tail sharply bicolor: dusky above and whitish below, except near tip, which is dark all round.

Cranial and dental characters.—Skull similar to that of *S. vagrans*, but slightly smaller; brain case flatter; interpterygoid fossa narrower. Teeth as in *vagrans.*

Measurements.—Average of 4 specimens from type locality: Total length, 96.5 mm.; tail vertebræ, 39 mm.; hind foot, 12.5 mm.

General remarks.—*Sorex nevadensis* is an easily recognized species, its dark back, finely mixed with hoary, and indistinctly tricolor coloration which suggests *S. richardsoni*, serving to distinguish it from its nearest allies. It is the only Shrew thus far discovered in the interior of the Great Basin.

SOREX OBSCURUS Merriam.

(Pl. VIII. figs. 1, 1*a*.)

Sorex vagrans similis Merriam, N. Am. Fauna, No. 5, pp. 34–35, Pl. IV, fig. 3, August, 1891. (Name preoccupied by *Sorex similis* Hensel, 1855,[1] and here changed to *obscurus*.)

Type locality.—Timber Creek, Salmon River Mountains, Idaho (altitude, 8,200 feet).

Geographic distribution.—British Columbia and mountains of western Washington, Idaho, Montana, Wyoming, Utah, and Colorado; south along the High Sierra Nevada in California to Mount Whitney. Restricted to Boreal zone.

General characters.—Size rather small; tail about equal to body without head; ears inconspicuous; third unicuspid much smaller than fourth. Similar to *Sorex dobsoni*, but with smaller ears, broader palate, and broader unicuspidate teeth. Compared with *S. vagrans*, it is slightly larger, with longer tail and larger molariform teeth.

Color.—Upper parts uniform dull sepia brown, under parts ashy; tail bicolor: upper side concolor with back or slightly darker, under side whitish. In winter pelage the upper parts are ash gray and the under parts nearly white.

Cranial and dental characters.—Skull similar to that of *S. dobsoni*, but palate broader; molariform teeth larger; unicuspidate teeth broader, particularly the first and second; third unicuspid decidedly smaller than fourth. Compared with *S. vagrans*, the skull is slightly longer (averaging 18 mm. instead of 17 mm.), with larger and heavier molariform teeth (particularly the large upper premolar) and broader first and second unicuspids. The actual differences in the size of the molariform teeth are shown in the following table:

Mean measurements of upper molariform teeth of Sorex obscurus, dobsoni, and vagrans.

[Measurements in $\frac{1}{100}$ mm.]

Species.	Locality.	Series.*a*	pm.	m¹.	m².
Sorex obscurus	Salmon River Mountains, Idaho	400	145	140	120
dobsoni	Saw Tooth Mountains, Idaho	372	137	128	115
vagrans	Aberdeen, Wash	345	125	120	105

a From antero-external angle of pm to postero-external angle of m².

---

[1] Hensel, Zeitschr. der Deutsch. Geolog. Gesellsch., VII, 1855, 459. From bone deposits of Cagliari, Sardinia.

Measurements.—Average of 8 specimens from type locality: Total length, 108 mm.; tail vertebræ, 46 mm.; hind foot, 12.8 mm.

General remarks.—*Sorex obscurus* is a common and widely distributed species, being the prevailing Shrew in southern British Columbia and northern Washington and in the Rocky Mountains and Sierra Nevada. A closely allied form (subspecies *longicauda*) occupies a narrow strip along the Pacific coast from the mouth of the Columbia northward to Wrangel, Alaska; another (subspecies *ventralis*) inhabits the mountains of Oaxaca, in southern Mexico.

Specimens examined.—Total number, 175, from the following localities:

Idaho: Salmon River Mountains (type locality), 8; Pahsimeroi Mountains, 1; Preuss Mountains, 1.

Utah: Wasatch Mountains, 1; Provo, 1; Manti, 3.

Colorado: Longs Peak, 1; Boulder County, 8; Fort Garland, 2; 3 miles east of Cochitope Pass (Monshower Meadows), 2; Silverton, 4.

Wyoming: Yellowstone Park, 3; Bridger Pass, 2; Woods, 1.

Montana: St. Marys Lakes, 9; Bear Paw Mountains, 2; Bear Tooth Mountains, 17; Upper Stillwater, Flathead County, 1.

California (all in Sierra Nevada): Carberry Ranch, Shasta County, 1; Greenville, Plumas County, 1; Donner, 1; Pine City, east slope Mammoth Pass, 1; head San Joaquin River, 3; Bishop Creek, 5; Mineral King, 2; Sequoia National Park (Halsted Meadows), 4; Horse Corral Meadows, 3; Mulkey Meadows, 1; North Fork Kern River, 1; East Fork Kaweah River, 7; South Fork Kern River, 3; Mount Whitney, 6; Round Valley, 12 miles south of Mount Whitney, 1; Kern Lakes (Soda Springs), 1.

Oregon: Drain (not typical), 4.

Washington (inclining toward *longicauda*): Head of Lake Chelan, 4; head of Cascade River, 2; Easton, 10; Lake Cushman, Olympic Mountains, 3.

British Columbia: Nelson, 6; Ward, 1; Field, 2; Glacier, 5; Golden, 1; Kamloops (Cariboo Lake), 2; Sicamous, 1; Goldstream, Vancouver Island, 5; Comox, 1; Sumas, 2; Port Moody (nearly *longicauda*), 4.

Alberta: Henry House, 2.

Mean measurements of Sorex obscurus, longicauda, and alascensis, showing progressive geographic variation in size.

	Total length.	Tail.	Hind foot.	No. of specimens in average.
Sorex obscurus:	*mm.*	*mm.*	*mm.*	
Salmon River Mountains, Idaho (type locality)	108	46	12.8	8
Yellowstone Park, Wyoming	111	46.6	13	3
Bear Tooth Mountains, Montana	112	46.5	13.1	15
St. Mary Lakes, Montana	116.5	47.6	13.5	9
Easton, Wash.	118.7	52.8	13.8	10
Sorex longicauda:				
Lake Cushman, Washington	123	53.7	13.8	4
Neah Bay, Washington	131	62	15	2
Wrangel, Alaska (type locality)	128.8	58.1	15.5	27
Loring, Alaska	129	58.1	15.3	11
Sorex alascensis:				
Juneau, Alaska	122.5	53.5	14.6	16
Yakutat, Alaska (type locality)	116.3	49.2	14.8	10

SOREX OBSCURUS LONGICAUDA subsp. nov.

Type from Wrangel, southeast Alaska. Type, No. 74711, ♂ yg. ad., U. S. Nat. Mus., Department of Agriculture collection. Collected September 9, 1895, by Clark P. Streator. Original number, 4891.

Geographic distribution.—Coast of southeast Alaska, from Wrangel southward; also coast of Washington, including Puget Sound and Skagit Valley.

General characters.—Size rather large; tail long, nearly equaling head and body; ears conspicuous. Similar to *S. bairdi* in color, length of tail, and external appearance; similar to *S. obscurus* in cranial and dental characters.

Color.—Upper parts dull, dark chestnut brown; under parts buffy ash, more or less suffused with dull, pale chestnut brown on the belly; tail bicolor: dark brown above, buffy below.

Cranial and dental characters.—Skull and teeth almost indistinguishable from *S. obscurus*, but larger; molariform teeth more deeply emarginate posteriorly, and middle upper molar narrower on inner side.

Measurements.—Average of 27 specimens from Wrangel, Alaska (type locality): Total length, 128.8 mm.; tail vertebræ, 58.1 mm.; hind foot, 15.5 mm. Average of 2 specimens from Neah Bay, Washington: Total length, 131 mm.; tail vertebræ, 62 mm.; hind foot, 15 mm. Average of 4 specimens from Aberdeen, Wash.: Total length, 122 mm.; tail vertebræ, 57 mm.; hind foot, 14.2 mm.

General remarks.—*Sorex obscurus* is a strictly boreal species, and in the United States it is exclusively a mountain animal, not descending to base level until British Columbia is reached. In the Puget Sound region, however, and along the ocean coast of Washington, and thence northerly to Alaska, it sends a representative all the way down to sea level. This representative is larger, has developed an exceedingly long tail, and has taken on certain peculiarities of coloration. It is here described as a subspecies, in the belief that intergradation with *obscurus* takes place.

Specimens examined.—Total number, 48, from the following localities:

Alaska: Wrangel (type locality), 27; Loring, Revillagigedo Island, 11.

Washington: Neah Bay, 2; Seattle, 1; Avon, 1; Hamilton, 1; Mount Vernon, 1; Aberdeen, 4.

In addition to the above, specimens more or less intermediate between *longicauda* and *obscurus* have been examined from Port Moody, British Columbia (3), and the following places in the State of Washington: Olympic Mountains (Lake Cushman), 4; head of Cascade River, 2; Easton, 10; head of Lake Chelan, 3.

SOREX OBSCURUS VENTRALIS subsp. nov.

Type from Cerro San Felipe, Oaxaca, Mexico (altitude, 10,000 feet). Type, No. 68342, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected August 26, 1894, by E. W. Nelson and E. A. Goldman. Original number, 6636.

General characters.—Size small; tail short; hind foot, 13 mm. Similar to *S. obscurus*, but tail shorter and coloration darker, particularly on under parts.

Color.—Upper parts finely mixed brownish (inclining to dull chestnut) and dusky, the one or the other predominating according to the pelage (the type specimen is in the brown pelage); under parts dull chestnut, passing gradually into color of sides. Tail bicolor: dusky above, soiled whitish beneath; line of demarcation usually distinct.

Cranial and dental characters.—Skull and teeth similar to those of *S. obscurus*, but molariform teeth slightly larger. The first true molar is essentially the same size in both, but the large premolar and second molar are slightly larger in *ventralis*.

Measurements.—Type specimen: Total length, 104 mm.; tail vertebræ, 37 mm.; hind foot, 13 mm. Average of 7 specimens from type locality: Total length, 105.4 mm.; tail vertebræ, 37.3 mm.; hind foot, 13 mm.

General remarks.—It is interesting to find the common boreal Shrew of British Columbia and the northern Rocky Mountains ranging southward, in a very slightly modified form, all the way to the mountains of extreme southern Mexico.

The 7 specimens from the type locality (Cerro San Felipe) were collected August 26 to September 1, and are about equally divided between the two pelages. The 9 from the mountains west of Oaxaca were collected September 12 to 18, and all are in the dark pelage.

Sorex obscurus ventralis differs from *S. oreopolus* much as it differs from typical *obscurus*, in having the under parts dull chestnut instead of ashy gray. The skull is broader and much shorter (particularly the brain case) and the second upper molar is broader.

Specimens examined.—Total number, 21, from the following localities, all in the State of Oaxaca, Mexico: Cerro San Felipe (type locality), 7; mountains 15 miles west of Oaxaca City, 9; mountains near Ozolotepec, 3; near Cajones, 2.

Mean measurements of Sorex obscurus ventralis from different localities in Oaxaca, Mexico.

Locality.	Total length.	Tail.	Hind foot.	No. of specimens in average.
	mm.	*mm.*	*mm.*	
Cerro San Felipe, Oaxaca, Mexico	105.4	37.3	12.9	7
Mountains 15 miles west of Oaxaca City, Oaxaca	105.3	41.2	13.7	9
Mountains near Cajones, Oaxaca	106	41	13.5	2
Mountains near Ozolotepec, Oaxaca	112	40	13.3	3

SOREX OBSCURUS ALASCENSIS subsp. nov.

Type from Yakutat Bay, Alaska. Type, No. 73539, ♀ yg. ad., U. S. Nat. Mus., Department of Agriculture collection. Collected July 10, 1895, by C. P. Streator.

General characters.—Size large; tail medium, about equal to body without head; hind foot nearly 15 mm. Similar to *S. obscurus*, but larger; similar to *S. longicauda*, but tail shorter; similar to *S. fumeus* of the northeastern United States, but third unicuspid decidedly smaller than fourth, as in most west American Shrews, and color different.

Color.—Upper parts uniform sepia brown, finely mixed with light-tipped hairs; under parts ash gray, the plumbeous showing through. Tail bicolor: above, dark brown; below, whitish; tip usually dusky all round.

Cranial and dental characters.—Skull similar in size and general characters to that of *S. fumeus*, from which it differs in the following points: Brain case shorter, somewhat more inflated above plane of rostrum, and slightly narrower; palate and postpalatal notch slightly narrower; first and second unicuspids more swollen; third much smaller than fourth; second upper true molar less deeply excavated posteriorly and shorter on lingual side. The rostrum, palate, and teeth are essentially the same as in *fumeus*, except that the third unicuspid is smaller than the fourth, as usual in western Shrews. The skull and molariform teeth of *Sorex alascensis* are decidedly larger than those of *S. obscurus* and smaller than those of *S. longicauda*. Compared with *S. obscurus* the difference in size of cranium is due almost wholly to the great development of the brain case, which in *alascensis* is not only larger in every way but is more highly inflated above the plane of the rostrum.

Measurements.—Type specimen: Total length, 115 mm.; tail vertebræ, 45 mm.; hind foot, 14.5 mm. Average of 10 specimens from type locality (Yakutat, Alaska): Total length, 116 mm.; tail vertebræ, 49 mm.; hind foot, 14.8 mm.

General remarks.—Externally *Sorex alascensis* resembles *S. longicauda* except that its tail is much shorter. This difference is well shown in the table of measurements given under *S. obscurus* (p. 73).

The type locality of *alascensis* is Yakutat, Alaska; the type locality of *longicauda* is Wrangel, Alaska. Juneau is intermediate in geographic position between Yakutat and Wrangel, and its Shrews of the *obscurus* group are, as might be expected, intermediate between *alascensis* and *longicauda*. A series of 16 specimens from Juneau differs from the Yakutat series in having the tail longer (averaging 53.5 mm. instead of 49.2 mm.), the ear slightly longer, the mddle upper molar less emarginate posteriorly, and the color more inclining to rufous (particularly in No. 74386, in which the upper parts are much darker and more rufous and the under parts strongly washed with the same color). But the difference in color is probably seasonal, as a few of the specimens which are still in summer pelage (as No. 74397) are like those from Yakutat. The Yakutat specimens were collected in July; the Juneau series about the middle of August. It is probable that complete intergradation exists between *alascensis* and *longicauda.*

SOREX OREOPOLUS Merriam.

(Pl. VIII, figs. 4, 4*a*.)

Sorex oreopolus Merriam, Proc. Biol. Soc. Washington, VII, 173, September 29, 1892.

Type locality.—North slope Sierra Nevada de Colima, Jalisco, Mexico (altitude, 10,000 feet).

General characters.—Size medium; tail and ears short; hind foot, 13 mm. Similar to *S. obscurus*, but tail much shorter; color much darker above and below; skull very much longer and more slender.

Color.—Upper parts finely mixed sepia brown and dusky, without chestnut tinge; under parts drab; tail bicolor: dusky above and all round at tip, soiled whitish beneath.

Cranial and dental characters.—Skull similar to those of *S. obscurus* and *ventralis*, but much longer and more slender, with brain case and constriction between brain case and rostrum especially elongated, and palate narrower. The second upper molar is narrower (inner side shorter) than in *ventralis.*

Measurements.—Average of 3 specimens from type locality: Total length, 104.7 mm.; tail vertebræ, 36.3 mm.; hind foot, 13.7 mm.

General remarks.—*Sorex oreopolus* has apparently the most restricted distribution of any Mexican *Sorex*, being known only from the Sierra Nevada de Colima, Jalisco. It belongs to the *S. obscurus* group, and is represented in the mountains of Oaxaca by a closely related form, *S. obscurus ventralis*, from which it may be distinguished by its much paler under parts, the absence of chestnut tinge from the sides and back, and the very much longer and more slender skull, as already pointed out.

Specimens examined.—Total number, 3; all from the type locality.

SOREX BAIRDI sp. nov.

(Pl. VII, figs. 3, 3*a*.)

Type from Astoria, Oregon. Type, No. $\frac{17414}{24318}$, ♀ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected August 2, 1889, by T. S. Palmer. Orig. No. 270.

Geographic distribution.—Coast of Oregon at mouth of Columbia River.

General characters.—Size, rather large; tail long; color dull brownish chestnut; external appearance as in *S. longicauda*, but skull larger and anterior unicuspids much more swollen.

Color.—Upper parts dull, dark chestnut brown; under parts dull chestnut brown (similar to back, but lacking the admixture of black-tipped hairs); tail bicolor: dark brown, almost dusky-above; flesh color, or pale buffy brownish, below.

Cranial and dental characters.—Skull similar to that of *obscurus*, but larger (averaging 20 mm. in length and 9 mm. in breadth); first and second unicuspids very large and broad, differing markedly from any known species.

Measurements.—Average of 9 specimens from type locality: Total length, 129 mm.; tail vertebræ, 57 mm.; hind foot, 15.1 mm.

General remarks.—After *Sorex pacificus*, *S. bairdi* is the largest of the west American Shrews of the restricted genus *Sorex*. Externally it resembles its geographical neighbor, *S. longicauda*, from which it differs strongly in the large size of its anterior unicuspidate teeth.

The species is remarkable in several respects. Geographically it is restricted to the coast of Oregon near Astoria, on the south side of the mouth of the Columbia River. On the north side of the river it is replaced by *S. longicauda*, a closely related species, whose affinities have been already discussed. It seems peculiarly appropriate that this large and handsome Shrew should perpetuate the name of Professor Baird, the pioneer in the study of west American Shrews.

SOREX TROWBRIDGII Baird.

(Pl. VII, figs. 4, 4*a*.)

Sorex trowbridgii Baird, Mamm., N. Am., pp. 13-15, 1857.

Type locality.—Astoria, mouth of Columbia River, Oregon.

Geographic distribution.—Western Washington and Oregon, west of Cascade Range.

General characters.—Size, rather large; tail long; ears conspicuous; color dark slate or sooty plumbeous, with no brownish or chestnut. Resembles *S. montereyensis* of California, but differs in marked cranial and dental characters.

Color.—Upper parts blackish slate or sooty plumbeous; under parts dull plumbeous; tail sharply bicolor: blackish above, whitish beneath; feet flesh color.

Cranial characters.—Contrasted with *S. montereyensis*, the only species with which it requires comparison, the skull of *S. trowbridgii* is thinner and more 'papery,' the brain case more globular, the palate much narrower. The molariform teeth and first and second unicuspids are decidedly smaller and narrower. The large upper premolar in particular is very much smaller than in *montereyensis.*

Measurements.—Average of 3 specimens from Astoria, Oregon (type locality): Total length, 121 mm.; tail vertebræ, 57.7 mm.; hind foot, 13.7 mm. Average of 5 specimens from Olympic Mts., Washington: Total length, 120 mm.; tail vertebræ, 57.8 mm.; hind foot, 13 mm.

General remarks.—*Sorex trowbridgii* may be distinguished at a glance from all other American Shrews, except the related *S. montereyensis*, by its large size, sooty plumbeous color, and long, sharply bicolor tail. The characters that distinguish it from *montereyensis* have been pointed out in the above diagnosis.

Specimens examined.—Total number, 19, from the following localities:

Washington: Seattle, 1; Steilacoom, 2; Tenino, 1; Olympic Mountains, 5; Aberdeen, 1.

Oregon: Astoria (type locality), 3; Beaverton, 1; Yaquina Bay, 1; Marshfield, 1; Siskiyou, 3.

SOREX MONTEREYENSIS sp. nov.

Type from Monterey, Calif. Type, No. $\frac{32000}{44810}$, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected October 1, 1891, by Vernon Bailey. Original number, 3336.

Geographic distribution.—Coast strip and Sierra Nevada of California; south on the coast at least to Morro and San Luis Obispo; south in the Sierra to Sequoia National Park and East Fork Kaweah River.

General characters.—Size large; tail long; ears prominent; color sooty black, becoming brownish in worn summer pelage. Similar to *S. trowbridgii*, but with slightly larger feet, broader palate, and larger molariform teeth.

Color.—Upper parts slate black, passing insensibly into dull plumbeous brown on the belly. In worn summer pelage the back becomes brownish. Tail sharply bicolor: blackish above, whitish beneath.

Cranial characters.—Skull similar to *S. trowbridgii* but slightly heavier, brain case less globular, palate and interpterygoid notch much broader. Molariform teeth and first and second unicuspids decidedly larger and broader. The large upper premolar alone is diagnostic of the species, contrasted with its small size in *trowbridgii.*

Measurements.—Average of 5 specimens from Monterey, Calif. (type locality): Total length, 120 mm.; tail vertebræ, 52.4 mm.; hind foot, 14.8 mm. Average of 4 specimens from Sequoia National Park, west slope Sierra Nevada: Total length, 120.5 mm.; tail vertebræ, 51.3 mm.; hind foot, 14 mm.

General remarks.—*Sorex montereyensis* is the California representative of *S. trowbridgii* from the coast region of Oregon and Washington, and requires comparison with no other species.

Specimens examined.—Total number, 33, from the following localities in California:

Coast Belt: Crescent City, 2; Eureka, 1; Nicasio, Marin County, 8; Boulder Creek, Santa Cruz County, 4; Monterey, 6; Morro, 2; San Luis Obispo, 1.

Sierra Nevada (west slope): Michigan Bluff, 1; Middle Fork American River, Eldorado County, 2; Sequoia National Park (Halsted Meadows), 5; East Fork Kaweah River, 1.

SOREX ORNATUS sp. nov.

(Pl. VIII, figs. 3, 3*a*.)

Type from head of San Emigdio Canyon, Mount Piños, California. Type, No. $\frac{31333}{43198}$, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected October, 19, 1891, by E. W. Nelson. Original number, 1328.

Geographic distribution.—Mountains of southern California, from head of Ventura River and Mount Piños easterly to San Bernardino Peak, and south through the San Jacinto range to Santa Ysabel.

General characters.—Similar to *S. californicus*, but larger, with much longer tail, larger ears and feet, and a dark rump patch.

Color.—Upper parts ash gray, becoming suddenly darker on the rump, the dark hairs forming a distinct patch or saddle on posterior half of the back, strongly contrasted with the clear gray of the shoulders and anterior part of back; under parts whitish, reaching far up on the sides. Tail indistinctly bicolor: dark above, and all round on distal half; pale below on proximal half.

Cranial and dental characters.—Skull similar to that of *californicus*, but larger and with the brain case narrower and higher. Large upper premolar decidedly larger than in *californicus;* molariform teeth very broadly and deeply excavated posteriorly.

Measurements (of type specimen in flesh).—Total length, 108 mm.; tail vertebræ, 43 mm.; hind foot, 13 mm. Average of 2 from San Bernardino Peak: Total length, 104 mm.; tail vertebræ, 42.5 mm.; hind foot, 12 mm.

General remarks.—The dark rump patch is probably a feature of the winter pelage, as it is hardly apparent in September specimens from the San Bernardino Mountains.

Specimens examined.—Total number, 7, from the following localities in southern California: Mount Piños and head of San Emigdio Canyon, 2; near head of Ventura River, 1; San Bernardino Peak, 2; Santa Ysabel, 2.

SOREX CALIFORNICUS sp. nov.

(Pl. XII, figs. 6, 7.)

Type from Walnut Creek, Contra Costa County, Calif. Type, No. $\frac{32578}{44426}$, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected February 15, 1892, by Clark P. Streator. Original number, 1583.

General characters.—Size small; tail shorter than body without head; hind foot about 11.5 mm.; ears conspicuous; skull small and flat; brain case hardly higher than rostrum.

Color.—Upper parts dark ash gray, with a decided 'pepper and salt' appearance, and sometimes washed with brownish; under parts plumbeous, tipped with whitish.

Cranial and dental characters.—Skull small and flat; brain case depressed, broadly flattened, and hardly higher than rostrum, with which it forms a nearly straight line; palate broad. Third unicuspid very small, hardly half as large as fourth. Molariform teeth similar to those of *S. vagrans*, but smaller.

Measurements.—Average of 4 specimens from Walnut Creek, California (type locality): Total length, 93 mm.; tail vertebræ, 34.5 mm.; hind foot, 11.5 mm.

General remarks.—*Sorex californicus* is the type of a new group of Shrews, previously overlooked, and easily distinguished by the flatness of the brain case. Three members of the group are here described, all of small size, namely, *S. californicus*, *S. tenellus*, and *S. nanus*.

Specimens examined.—Total number, 7, from the following localities in California: Glen Ellen, Sonoma County, 1; Walnut Creek, Contra Costa County (type locality), 4; Berkeley, Alameda County, 2.

SOREX TENELLUS sp. nov.

(Pl. XII, figs. 8, 9.)

Type from summit of Alabama Hills near Lone Pine, Owens Valley, Calif. Type, No. $\frac{25083}{32495}$, ad., U. S. Nat. Mus., Department of Agriculture collection. Collected December 22, 1890, by E. W. Nelson. Original number, 131.

General characters.—Size small; coloration pale; skull flat, as in *S. californicus*, but smaller and much narrower.

Color.—Upper parts pale ash gray, under parts and feet white; tail bicolor: dark above, white beneath.

Cranial and dental characters.—Skull small, slender, and very flat; brain case depressed to plane of rostrum, which is nearly horizontal; palate narrow. Teeth much as in *S. californicus.*

Measurements (in flesh).—Type specimen: Total length, 103 mm.; tail vertebræ, 42 mm.; hind foot, 12.5 mm. Average of 2 specimens from White Mountains, California: Total length, 98 mm.; tail vertebræ, 41 mm.; hind foot, 12.2 mm.

General remarks.—*Sorex tenellus* is a third member of the group of flat-skulled Shrews comprising *S. californicus* and *S. nanus*. It differs strikingly from *californicus* in the narrowness of its skull.

Specimens examined.—Total number, 3, from the following localities in southeastern California: Alabama Hills, near Lone Pine, Owens Valley, 1; White Mountains, 2.

SOREX TENELLUS NANUS subsp. nov.

(Pl. VIII, figs. 5, 5*a*.)

Type from Estes Park, Colorado. Type, No. 73773, ♀ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected August 3, 1895, by E. A. Preble.

General characters.—One of the smallest of the American Shrews (hind foot, 10 mm.). Similar to *S. tenellus*, but smaller and darker; skull more slender and teeth smaller.

Color.—Upper parts sepia brown, darkest on the back, under parts and feet grayish ash; tail bicolor: upper side concolor with back, except at tip, which is decidedly darker, under side whitish.

Cranial and dental characters.—Skull similar to that of *tenellus*, but even smaller and more slender; anterior part of rostrum narrower and more attenuate; constriction less swollen; palate narrower; molariform teeth smaller (especially m^1). Compared with *S. longirostris*, the whole skull is much flatter and more slender.

Measurements.—Type specimen: Total length, 105 mm.; tail vertebræ, 42 mm.; hind foot, 10 mm.

General remarks.—The discovery in Colorado of a representative of the tiny California *Sorex tenellus* is as interesting as it was unexpected. True *tenellus* inhabits the mountains of Owens Valley and the White Mountains on the border between California and Nevada. The closely related form here described as *nanus* was collected at Estes Park, Colorado, by Mr. E. A. Preble.

Specimens examined.—Total number, 4, from the following localities:

Colorado: Estes Park (type locality), 2; West Cliff (Custer County), 1.
Montana: Fort Custer, 1.

SOREX MACRODON sp. nov.

(Pl. VII, figs. 2, 2*a*; Pl. XII, figs. 12, 13.)

Type from Orizaba, Vera Cruz, Mexico (altitude, 4,200 feet). Type, No. 58272, ♂ yg. ad., U. S. Nat. Mus., Department of Agriculture collection. Collected January 26, 1894, by E. W. Nelson and E. A. Goldman. Original number, 5759.

General characters.—Size rather large; ears large; tail long; coloration dusky. Almost indistinguishable externally from *S. caudatus*, but with skull and teeth much larger and more massive.

Color.—Upper parts finely mixed sepia and black, the black usually predominating, particularly on the posterior half of the back; under parts seal brown; tail blackish above, paler beneath, without line of demarcation; feet blackish.

Cranial and dental characters.—Skull large and heavy (20 by 9.5 mm.) with large brain case; rostrum high; anterior nares remarkably large, and with thickened borders; palate and interpterygoid fossa broad. Third unicuspid small, hardly half as large as fourth. Molariform teeth very large and massive.

Measurements.—Type specimen: Total length, 128 mm.; tail vertebræ, 52 mm.; hind foot, 15.5 mm. Average of 5 specimens from type locality: Total length, 125 mm.; tail vertebræ, 50.2 mm.; hind foot, 15.3 mm.

General remarks.—*Sorex macrodon*, while hardly distinguishable externally from *S. caudatus*, may be told at a glance by the heavy skull and teeth. The skull suggests that of *Blarina*, particularly in the large size and thickened borders of the anterior nares.

Specimens examined.—Total number, 10, from the following localities in southern Mexico:

State of Vera Cruz: Orizaba (type locality), 5; Jico, 3.
State of Oaxaca: Totontepec, 2.

SOREX VERÆPACIS Alston.

Sorex veræ-pacis Alston, Proc. Zool. Soc. London, 1877, 445–446; Biologia Centrali-Americana, p. 55, Pl. col. V, fig. 1, 1880.

Sorex pacificus Dobson, Monog. Insectivora, Part III, Pl. XXIII, fig. 8 (not *S. pacificus* Baird).

Type locality.—Coban, Guatemala.

General characters.—Size rather large; tail long; color very dark; third unicuspid smaller than fourth.

Color.—"Nearly uniform dark dusky brown, hardly lighter beneath; feet and tail dusky."

Cranial and dental characters.—The skull of *S. veræpacis* I have not seen, but judging from Alston's rather poor figures it presents no unusual characters, except that the molariform series converge posteriorly, leaving the roof of the mouth broadest on the plane of the first true molar. Alston states that the first upper incisor has a well-marked internal cusp and that the canine (fourth unicuspid) is slightly smaller than the fourth incisor (third unicuspid); but Mr. Oldfield Thomas, curator of mammals in the British Museum, who has kindly reexamined the type at my request, writes me that the contrary is true. Mr. Thomas says: "*Sorex veræpacis* has the fourth unicuspid distinctly higher than the third, so Alston's description is wrong." The relations of these teeth are correctly shown in Dobson's Monograph of the Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 8.

Measurements.—The measurements recorded by Alston from the mounted specimens are, approximately: Total length, 137 mm.; tail vertebræ, 51 mm.; hind foot, 13.5 mm. The measurement of the hind foot is erroneous. Mr. Oldfield Thomas finds that it measures 15.7 mm.

General remarks.—The two original specimens of *Sorex veræpacis* were brought to England from Coban, Guatemala, more than half a century ago, and are still unique.[1] The species finds its nearest relative in *S. macrodon*, of Orizaba, Mexico. Mr. Thomas, who has compared *S. macrodon* with the type of *veræpacis*, writes me that the latter is much the darker and that the third and fourth unicuspids are very different in shape.

SOREX SAUSSUREI Merriam.

Sorex saussurei Merriam, Proc. Biol. Soc. Washington, VII, 173-174, September 29, 1892.

Type locality.—North slope Sierra Nevada de Colima, Jalisco, Mexico (altitude, 8,000 feet).

General characters.—Size rather large; tail rather short (shorter than body without head); ears large; hind foot, 14.5 mm.

Color.—Upper parts finely mixed sepia brown and dusky, the dark hairs predominating over the rump; under parts drab gray on throat and breast, more or less clouded over the belly; tail dark, paler below proximally.

Cranial and dental characters.—Skull large; rostrum high and swollen; constriction broad; brain case not abruptly elevated; palate rather narrow; postpalatal notch broad; third unicuspid slightly smaller than fourth. The skull of *Sorex saussurei* hardly needs comparison with any other species. It is very much larger than any member of the *obscurus* group, and is nearly as large as *S. macrodon*. It may be known from the latter at a glance by the smaller molariform teeth and more slender anterior part of rostrum, with much smaller anterior nares.

Measurements.—Average of 2 specimens from type locality: Total length, 118.5 mm.; tail vertebræ, 47 mm.; hind foot, 14.5 mm.

---

[1] Since the above was printed 5 specimens have been received from Tumbala, Chiapas, Mexico.

General remarks.—The only Shrews that resemble *S. saussurei* externally are its subspecies *caudatus* and *S. macrodon*, from both of which it differs in greater length of tail and paler color of under parts.

Sorex saussurei is an exceedingly interesting type, inhabiting, either in its typical form or as subspecies *caudatus*, most of the higher mountains of southern Mexico, from the volcano of Colima on the west to Mount Orizaba on the east. On mapping the distribution of the typical form and the subspecies separately, it is found that the former inhabits the mountains whose watershed finds its way to the Pacific, while the latter is confined to those on the Atlantic slope. Specimens from Cerro San Felipe, Oaxaca, on the border land between the two, are intermediate in characters.

Specimens examined.—Total number, 24, from the following localities:

State of Jalisco: North slope of Sierra Nevada de Colima, 2.

State of Michoacan: Nahuatzin, 5.

State of Mexico: Mount Popocatepetl, 2; Salazar, 2; North slope of volcano of Toluca, 1.

State of Morelos: Tetela del Volcan, 1.

State of Oaxaca: Mountains 15 miles west of Oaxaca City, 1; mountains near Ozolotepec, 4; Tlapancingo, 2; Tamazulapam, 2.

State of Guerrero: Mountains near Chilpancingo, 2 (not typical).

SOREX SAUSSUREI CAUDATUS subsp. nov.

Type from Reyes, Oaxaca, Mexico (altitude 10,200 feet). Type, No. 69600, ♀ yg. ad., U. S. Nat. Mus., Department of Agriculture collection. Collected October 21, 1894, by E. W. Nelson. Original number, 6963.

General characters.—Similar to *S. saussurei*, but tail much longer (averaging 57 instead of 47 mm.); hind foot slightly longer; color of under parts darker.

Color.—Upper parts finely mixed sepia and blackish; under parts seal brown, passing insensibly into the color of the back; feet and tail blackish, the latter fading to brownish underneath.

Cranial and dental characters.—Skull and teeth similar to those of *saussurei*, but averaging slightly larger, with brain case somewhat higher. Third unicuspidate tooth slightly smaller than fourth.

When good series of skulls are available from single localities (as from Reyes and Mount Zempoaltepec) it is found that two types exist in each: (1) A large skull with high brain case, large m^3 (with squarish body), long unicuspidate row, the anterior teeth of which are not markedly swollen; and (2) a slightly smaller skull with flatter brain case, smaller m^3 (with narrower body and rounded angles), shorter unicuspidate row, the first and second teeth of which are conspicuously swollen (broadened). I incline to look upon these differences as sexual, though they do not uniformly correspond to the sex marks on the labels. But in the *Soricidæ*, as in the *Geomyidæ*, it is not safe to pin one's faith too closely on the collector's sexing.

Measurements.—Type specimen: Total length, 126 mm.; tail vertebræ, 57 mm.; hind foot, 14.5 mm. Average of 11 specimens from type locality (Reyes, Oaxaca): Total length, 125 mm.; tail vertebræ, 56.6 mm.; hind foot, 14.8 mm.

General remarks.—*Sorex saussurei caudatus* is simply a long-tailed form of *saussurei*, differing slightly in coloration. Its distribution is complemental to that of *saussurei*, as it inhabits mountain slopes of southeastern Mexico, while typical *saussurei* occupies the mountains of southwestern Mexico. On Mount Zempoaltepec it presents greater range of variation than elsewhere.

Specimens examined.—Total number, 41, from the following localities in southern Mexico:

Oaxaca: Reyes (type locality), 11; Totontepec, 5; Mount Zempoaltepec, 11; Cerro San Felipe, 4.

Vera Cruz: Jico, 5; Mount Orizaba, 4; Las Vigas, 1.

SOREX LONGIROSTRIS Bach.

(Pl. IX, figs. 6, 6*a*.)

Sorex longirostris Bachman, Jour. Acad. Nat. Sci. Phila., III, Part. II, 370–373, Pl. XXIII, fig. 2, 1837.

Type locality.—Swamps of Santee River, South Carolina.

Geographic distribution.—Austroriparian fauna of North and South Carolina, and probably Georgia and Florida also.

General characters.—Size small (hind foot, 11 mm. or less); tail shorter than body without head; ears large and conspicuous; third unicuspid smaller than fourth, as in the west American Shrews.

Color.—Upper parts chestnut brown, changing rather abruptly to color of under parts, which is ashy tinged with drab; upper side of tail dark, under side pale brownish.

Cranial and dental characters.—Skull smallest of the American species except *S. nanus*, from Colorado, with which it agrees in size and many important characters. It differs from all the other species of the genus in eastern America, and agrees with most of those from the West, in having the third unicuspid decidedly smaller than the fourth. Compared with *S. nanus* of Colorado, the whole cranium is higher; constriction broader and more swollen; palate broader and more arched; anterior part of rostrum broader, shorter, and less attenuate. Molariform teeth small and moderately excavated posteriorly; unicuspids broad and crowded; first and second subequal; third about half as large as second and decidedly smaller than fourth; fifth relatively large.

Measurements.—Average of 6 specimens from Raleigh, N. C.: Total length, 85.6 mm.; tail vertebræ, 31.9 mm.; hind foot, 10.7 mm.[1]

General remarks.—So far as I am aware, the only specimens extant of Bachman's *Sorex longirostris* are the half dozen collected at Raleigh, N. C., by H. H. and C. S. Brimley. These specimens, I am informed, were captured on high ground, while the type came from a swamp on the Santee River. The question might be raised whether the form from Dismal Swamp here described as new (*S. fisheri*) may not be the true *longirostris* instead of the one from Raleigh. The only facts at hand bearing on this point are the measurements originally recorded by Bachman; these indicate an animal even smaller than the Raleigh form, while the Dismal Swamp form is very much larger. The name *longirostris* is unfortunate, since the rostrum in this species is shorter and broader than in the common small Shrew of the Eastern States (*S. personatus*).

---

[1] For these measurements, taken in the flesh, I am indebted to H. H. and C. S. Brimley, of Raleigh, N. C.

SOREX FISHERI sp. nov.

(Pl. IV, fig. 4.)

Type from Lake Drummond, Dismal Swamp, Virginia. Type, No. 75166 ♂ ad., U. S. Nat. Mus., Dept. Agriculture coll. Collected Oct. 11, 1895, by A. K. Fisher. Orig. No. 1800.

General characters.—Similar to *S. longirostris*, but larger; hind foot decidedly longer (12 mm. instead of 10.7 mm.); ears larger; coloration duller, that of under parts less different from upper parts; nose and ears darker; skull much larger and heavier.

Color.—Dull chestnut brown, fading to drab brown on under parts; nose, ears, and upper side of tail very dark; under side of tail pale brownish except at tip, which is dark all round.

Cranial and dental characters.—Skull and teeth similar to those of *S. longirostris*, but very much larger; whole cranium higher; palate broader; molariform teeth larger throughout.

Measurements.—Type specimen: Total length, 108 mm.; tail vertebræ, 39 mm.; hind foot, 12 mm. Average of 4 specimens from type locality: Total length, 103 mm.; tail vertebræ, 38.2 mm; hind foot, 12.2 mm.

General remarks.—Unfortunately, no specimens of *S. longirostris* from the type locality (swamps of Santee River) are at hand. The above comparison has been made with specimens from Raleigh, N. C., which are assumed to be typical.

SOREX PACIFICUS Baird.

(Pl. VII, figs. 1, 1*a*.)

Sorex pacificus Baird, in Coues' Precursory Notes on American Insectivorous Mammals, Bull. U. S. Geol. and Geog. Surv., III, 3, p. 650, May 15, 1877. Type from Fort Umpqua, Oregon.

Type locality.—Fort Umpqua, mouth of Umpqua River, Oregon.

Geographic distribution.—A narrow belt along the Pacific Coast from Point Reyes, California, to Yaquina Bay, Oregon.

General characters.—Size, largest of the American Long-tailed Shrews of the restricted genus *Sorex;* color unique, cinnamon rufous; ears conspicuous; hind foot large; tail about equal to body without head.

Color.—In summer pelage, uniform cinnamon rufous above and below; in winter pelage, everywhere darker, the upper parts darkened by dark-tipped hairs. (This pelage is sometimes assumed early.)

Cranial and dental characters.—Skull large and massive, suggesting that of *Blarina.* Brain case broad and flattened, rounded laterally. Zygomatic ridge of squamosal strongly developed, forming a horizontal shelf. First and second unicuspids subequal; third about half as large as second; fourth abruptly larger than third, but not so large as second; fifth variable, usually only slightly smaller than third, and tipped with orange.

Measurements.—Average of 10 specimens from coast of northern California and southern Oregon: Total length, 150 mm.; tail vertebræ, 63 mm.; hind foot, 17 mm.

General remarks.—*Sorex pacificus* stands alone and does not require comparison with any other species, its great size and peculiar cinnamon-rufous color serving to distinguish it at sight. Externally, when in the dark pelage, it resembles the subgenus *Atophyrax* perhaps more closely than any species of true *Sorex.*

Specimens examined.—Total number, 13, from the following localities on the Pacific Coast.

Oregon: Yaquina Bay, 1; mouth of Umpqua River (type locality), 3; Marshfield, 1; Myrtle Point, 1.

California: Crescent City, 3; Eureka (Humboldt Bay), 2; Point Reyes (Marin County), 2.

SOREX PRIBILOFENSIS sp. nov.

(Pl. IX, figs. 3, 3*a*.)

Type from St. Paul Island, Pribilof Islands, Bering Sea. Type, No. 30911, ♀ ad. Collected July 29, 1891, by C. Hart Merriam. (Alcoholic.)

General characters.—Size rather small; tail short, thick, and remarkably hairy; ears conspicuous; hind foot, 13 mm. Unicuspids greatly swollen, diminishing from before backward as in *S. personatus;* third larger than fourth. Body distinctly tricolor.

Color.—Head and a band down the back chocolate brown; sides dull ochereous buff, fading into the soiled whitish of under parts; chin, throat, and feet white; tail sharply bicolor: narrowly brown above, broadly white beneath.

Cranial and dental characters.—Skull short and thick; constriction between brain case and rostrum greatly swollen; palatopterygoids very broad. Anterior unicuspids (first, second, and third) much swollen (very broad transversely). The skull of *Sorex pribilofensis* does not require comparison with any American Shrew. Contrasted with *S. personatus,* with which it agrees in length, it is everywhere broader and heavier, the constriction between brain case and rostrum very much broader; the brain case more truncate posteriorly; the rostrum and palatopterygoids broader, and the unicuspidate teeth very much broader.

Measurements.—Type (♀ ad.): Total length, 107 mm.; tail vertebræ, 35 mm.; hind foot, 13.5 mm. Average of 5 specimens from type locality: Total length, 105 mm.; tail vertebræ, 34.5 mm.; hind foot, 13.2 mm.

SOREX MERRIAMI Dobson.

(Pl. IX, figs. 4, 4*a*; Pl. XII, figs. 10, 11.)

Sorex merriami Dobson, Monog. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 6 (type). May, 1890.

Type locality.—Fort Custer, Montana. (Type, No. $\frac{1001}{4861}$, ♀ ad., Merriam collection.) Collected December 26, 1884, by Maj. Charles E. Bendire. Original number, 635.

General characters.—Size medium (hind foot, 12 mm.); tail hardly as long as body without head; ears very large (4 mm. from crown and 5 mm. from upper base); coloration peculiar: upper parts pale; under parts, sides, and tail white or nearly white.

Color (of type specimen dried from alcohol).—Head and back ash gray or drab with a buffy tinge; sides and under parts pure white; feet and tail whitish; the latter white below and buffy white above.[1]

Cranial and dental characters.—Skull short, broad, and swollen, unlike any known American shrew. Brain case rather flat, not elevated above plane of rostrum; constriction broad and swollen; rostrum and palate remarkably broad and short. The palate is broad for the entire length of the molariform series and then contracts rather abruptly. The unicuspidate and molariform teeth are in the same plane, the usual angle being nearly obsolete. The unicuspidate series are short and slope strongly inward. The unicuspid teeth are crowded, nearly vertical, and but slightly imbricating; the second is decidedly the largest tooth; first and third subequal; fourth decidedly smaller than third; fifth minute as usual. The large upper premolar and first true molar are broadly and deeply excavated posteriorly. The middle incisor has no secondary cusp on its inner side. The mandible is short and heavy.

In some respects the skull resembles that of *S. pribilofensis*, particularly in the great breadth of the constriction; but the two hardly need comparison, the unusual breadth of the palate, flatter brain case, smaller anterior nares, larger molars, and more crowded unicuspids of *S. merriami* serving to distinguish it at a glance.

Measurements (of type specimen, a well-preserved alcoholic).—Total length, 90 mm.; tail vertebræ, 36 mm.; hind foot, 11 mm.

General remarks.—The type and only known specimen of this remarkable Shrew was presented to me by Maj. Charles E. Bendire, who collected it at the post garden, on the Little Big Horn River, about a mile and a half above Fort Custer, Mont., December 26, 1884. I sent it, with all of my other Shrews, to Dr. George E. Dobson, who was then engaged on a monographic revision of the Soricidæ. Unfortunately, owing to Dr. Dobson's continued ill health, all that has ever been published of this monograph is a fasciculus of plates, showing the jaws and teeth of certain species, with a page of explanation facing each plate. (Monog. Insectivora, Part III, fasc. 1, May, 1890). The present species is named and its peculiar dentition shown in Pl. XXIII, fig. 6, of this work. But the remarkable shape of the palate and peculiarities of the skull as a whole are not shown. The skull was removed from the alcoholic specimen by Dr. Dobson, and I have sometimes wondered whether by any possible accident it could have been transposed with that of some Asiatic species, it is so very unlike all known American Shrews. When the specimen was returned the alcoholic bore my original label and number (1001), but the skull was numbered differently (1886; its proper number is 4861). Dr. Dobson afterwards wrote me that his number was an error, and that the skull belonged to my alcoholic No. 1001.

---

[1] In a note accompanying the specimen the collector, Major Bendire, states that the original color was different from that of the other Shrews (*S. personatus*), being "much more bluish."

Subgenus MICROSOREX Baird, 1877.

Microsorex Baird, in Coues Precursory Notes on American Insectivorous Mammals, Bull. U. S. Geol. and Geog. Surv., III, 646, May 15, 1877. Type, *Sorex hoyi* Baird.

Geographic distribution.—Boreal zone from northern New England and the Maritime Provinces of Canada (on both sides of the St. Lawrence) westward to British Columbia. Not known to range southward on any of the mountain systems.

Diagnosis.—Teeth 32, as in *Sorex*, but third unicuspid minute, transversely elongated, and wedged in between second and fourth so as to be hardly visible (and often not visible) from outer side (see Pl. IX, figs. 5*a*, 5*c*). The ridge on inner side of first and second unicuspids tends to develop a small accessory cusp at base, just above the cingulum.[1] Brain case narrow, depressed, and much elongated (Pl. XII, figs. 4, 5). Mandible relatively short and heavy (Pl. IX, fig. 5*b*). The mandible, compared with that of *Sorex personatus*, is shorter and heavier, with the coronoid process upturned more nearly at right angles to the ramus. The anterior lower incisor reaches posteriorly completely under the first and second and partly under the third lateral tooth.

The subgenus is represented, so far as known, by a single species of very small size.

SOREX (MICROSOREX) HOYI Baird.

(Pl. IX, figs. 5–5*c*; Pl. XII, figs. 4, 5.)

Sorex hoyi Baird, Mammals N. Am., 32–33, Pl. XXVIII, 1857. (From Racine, Wis.)
Sorex thompsoni Baird, Mammals N. Am., 34–35, Pl. XXVII. (From Burlington, Vt.)

Type locality.—Racine, Wisconsin.

General characters.—Size small (hind foot 10.5 mm.); tail considerably shorter than body without head; third unicuspidate tooth minute, scarcely visible between second and fourth.

---

[1] This cusplet may be seen also in *Sorex personatus*, though commonly less developed. It is figured by Miller on page 42 of this number of N. Am. Fauna (fig. 1c).

Color.—Upper parts sepia brown; under parts ashy gray, washed with buffy on throat and breast, and sometimes on belly also; tail bicolor: dark brown above, whitish beneath.

Cranial and dental characters.—Skull smallest of the known American Shrews except *S. nanus* (15.5 by 6.5 mm.[1]), and differing from all in the subgeneric characters already described. The brain case is low, long, and rather narrow, the constriction relatively broad, and the rostrum medium. Viewed from below, the sides of the rostrum converge gradually, without apparent angle between the molariform and unicuspidate series. The lower jaw is relatively large and heavy, and the styliform angular process is very long. The molars do not present any marked peculiarities. The unicuspids, viewed from the outer side, seem to be three in number, the third and fifth being so minute and internal as to escape notice; in fact, in some skulls they can not be seen at all from the outer side. The middle incisors have a large inner lobe.

General remarks.—*Sorex hoyi* has been supposed to have a very restricted distribution, but the specimens secured in recent years show it to range from British Columbia on the west almost to Labrador on the east. It is the type, and, so far as known, the sole representative, of Baird's subgenus *Microsorex*, a division which in the future is likely to be raised to full generic rank.

The material now available is insufficient to determine whether or not the British Columbia form is entitled to subspecific separation.

Measurements.—Average of 3 alcoholic specimens (in good condition) from Elk River, Minn.: Total length, 81.7 mm.; tail vertebræ, 30.7 mm.; hind foot, 10.7 mm. Average of 5 alcoholic specimens from Godbout, Quebec, Canada: Total length, 83 mm.; tail vertebræ, 32 mm.; hind foot, 10.5 mm. A single alcoholic specimen from Fort St. James, Stuart Lake, British Columbia, measures: Total length, 88 mm.; tail vertebræ, 31 mm.; hind foot, 9.5 mm.

Specimens examined.—Total number, 23, from the following localities:

Canada: Godbout, Quebec, 5; Digby, Nova Scotia, 1; Red River Settlement, Manitoba, 1; Fort St. James (Stuart Lake), British Columbia, 1.
Minnesota: Elk River, 11.
North Dakota: Devils Lake, 1.
New York: Locust Grove, Lewis County, 3.

Subgenus NEOSOREX Baird, 1857.

Neosorex Baird, Mammals N. Am. p. 11. Pl. XXVI, 1857. Type, *Neosorex navigator* Baird.

Geographic distribution.—The Sierra Nevada of California, the Rocky Mountains from Colorado northward, and boreal parts of eastern North America from plains of North Saskatchewan to Minnesota, the Adirondacks of New York, northern New England, and eastern Canada on both sides of the St. Lawrence.

---

[1] A very old skull from Locust Grove, N. Y., measures only 14 by 5.8 mm., and is the smallest Shrew skull I have ever seen. A young adult from the same locality measures 15 by 6.5. mm.

Diagnosis.—Feet large; hind foot very long, broad, somewhat oblique, and fimbriate for swimming; toes all fimbriate, the third and fourth united at base and slightly webbed.

The known members of the subgenus are of large size (much larger than any species of true *Sorex*), have long tails, and are white underneath at least part of the year. I am not aware of any cranial or dental characters by which *Neosorex* may be distinguished from *Sorex*, although the brain case is unusually broad and broadens abruptly from the rostrum, as in *Atophyrax*.

Number of representatives.—Three members of the subgenus *Neosorex* have been described: (1) *palustris*, from the region between the Rocky Mountains and Hudson Bay; (2) *navigator*, from the Rocky Mountains and Sierra Nevada; and (3) *albibarbis*, from the mountains of northern New England and northern New York. Still another species, *Sorex hydrodromus* Dobson, from Unalaska Island, is here referred to *Neosorex*, though I have not seen specimens, and its exact affinities are uncertain.

SOREX (NEOSOREX) PALUSTRIS Rich.

(Pl. X, figs. 5–7.)

Sorex palustris Richardson, Zool. Jour., III, No. 12, p. 517, January to April, 1828.

Type locality.—Marshy places from Hudson Bay to the Rocky Mts.

Geographic distribution.—Parts of the Boreal zone from Minnesota to the east base of the Rocky Mountains.

Habitat.—Streams, lakes, and marshes.

General characters.—Size very large (total length, 155 mm. or more; hind foot, 19 to 20 mm.); tail long; coloration of body and tail sharply bicolor; unicuspids broad.

Color.—Upper parts dusky, finely mixed with hoary; under parts dull white, sometimes clouded across breast and in anal region; tail sharply bicolor: blackish above and all round near tip, white below, the white narrower than the black; feet dark on outer side, whitish on inner side.

Cranial and dental characters.—(Specimen No. 69177, ♂ ad., from South Edmonton, Alberta). Skull large (22.5 by 10.2 mm.); brain case elevated decidedly above plane of rostrum; palate and postpalatal notch rather broad. Molariform teeth large and heavy, deeply excavated posteriorly. Unicuspidate teeth only slightly imbricating, the first and second subequal and very broad (transverse diameter equal to or greater than antero-posterior); third abruptly very much smaller; fourth much larger than third and about two-thirds size of second.

Measurements.—Richardson's measurements of the species are: Total length, 155 mm.; tail vertebræ, 65.5 mm.; hind foot, 19 mm. A specimen from Edmonton, Alberta, collected by J. Alden Loring, measured in the flesh: Total length, 157 mm.; tail vertebræ, 68 mm.; hind foot, 20 mm.—a remarkably close agreement.

General remarks.—*Sorex palustris* requires comparison with two closely related forms which it separates geographically, and with both of which it probably intergrades—*S. albibarbis* of the mountains of northern New England and New York (and probably Ontario also), and *S. navigator* of the Rocky Mountains and Sierra Nevada. From the former it may be distinguished by its white belly and sharply bicolor tail at all seasons; from the latter by larger size, darker color of upper parts, and much broader unicuspids.

Specimens examined.—Total number, 9, from the following localities:

Alberta: South Edmonton, 1.
Minnesota: Tower (Vermilion Lake), 1; Elk River, 7.

SOREX (NEOSOREX) PALUSTRIS NAVIGATOR (Baird.)

(Pl. XI, figs. 1-6.)

Neosorex navigator (Cooper MS.) Baird, Mam. N. Am., pp. 11-12, Pl. XXVI, 1857.
Sorex palustris Merriam, N. Am. Fauna No. 5, p. 35, August, 1891. (Idaho.)

Type locality.—Unknown; probably northern Idaho.[1]

Geographic distribution.—The Rocky Mountains and outlying ranges from British Columbia to southern Colorado, and the Sierra Nevada of California south to the Sequoia National Park.

Habitat.—Mountain streams.

General characters.—Similar to *N. palustris*, but decidedly smaller; coloration more plumbeous.

Color.—Upper parts plumbeous, finely mixed with hoary; under parts varying from silvery white to dull white, often clouded across the breast and on anal region; tail sharply bicolor: dusky above and all round near tip, white below.

Cranial characters.—Skull and teeth similar to those of *palustris*, but decidedly smaller (skull of type 20.5 by 9.6 mm.); brain case flatter; palate and interpterygoid fossa narrower. Unicuspidate teeth narrow (transverse diameter much less than antero-posterior instead of greater).

---

[1] Baird gave the locality of the type specimen as Fort Vancouver, Wash. But Dr. Cooper, who collected it, states: "According to the label now attached [this specimen] was found at Fort Vancouver, but I am inclined to consider this a mistake, and that it was really taken while swimming under water in a lake near the summit of the Cascade Mountains." It is evident that the type specimen, like many other alcoholic mammals collected in the early days, was not labeled until long after its capture, and that little dependence can be placed on either of the alleged localities. Furthermore, since the subgenus *Neosorex* is unknown from the Cascade region, and probably does not inhabit western Oregon or Washington, which region is occupied by the allied subgenus *Atophyrax*, it is highly improbable that the specimen came from either of the alleged localities. It agrees closely with specimens from western Montana, and probably came from some point in northern Idaho or the mountains east of Fort Colville, in extreme northeastern Washington, which region was visited by Dr. Cooper during the same expedition.

Measurements.—Baird's measurements of the alcoholic type specimen are, approximately: Total length, 127 mm.; tail vertebræ, 72 mm.; hind foot, 20 mm. The total length is much too small, due to the contraction of the body in alcohol. Average of 8 specimens from Pryor Mountains, Montana: Total length, 148.4 mm.; tail vertebræ, 71.5 mm.; hind foot, 20.4 mm. Average of 12 specimens from Cottonwood Meadows, Mount Whitney, California: Total length, 159.2 mm.; tail vertebræ, 76 mm.; hind foot, 20.2 mm.

General remarks.—*Neosorex navigator* fluctuates considerably in size in the various mountain ranges it inhabits, and seems to intergrade completely with *S. palustris.* Specimens from the Bighorn and Wind River mountains in Wyoming are fairly intermediate, and it is probable that intergrades will be found along the east base of the Rocky Mountains in Alberta. Typical *palustris* occurs on the plains at Edmonton, Alberta, while unmistakable *navigator* is found in the Rocky Mountains at Banff and Henry House, Alberta.

The palate is relatively narrower in the type specimen; broader in specimens from most parts of the Rocky Mts. and the Sierra Nevada.

Specimens examined.—Total number, 77, from the following localities:

British Columbia: Nelson, 3.

Alberta: Banff, 2; Henry House, Rocky Mountains, 1.

Montana: Pryor Mountains, 8; Upper Stillwater Lake, 1; Flathead Lake, 5; Paola (Great Northern Railroad), 1; St. Marys Lakes, 1; Bear Tooth Mountains, 1; Red Lodge, 3.

Idaho: Head of Crow Creek, 1; Head of Wood River, 1; Salmon River Mountains, 5; Birch Creek, 6; Saw Tooth Lake, 3.

Wyoming: Bighorn Mountains, 1; Wind River Mountains, 2.

Utah: Wasatch Mountains, 6; Park City, 1.

Colorado: Gold Hill, Boulder County, 2; Cochetope Pass, 1.

California (Sierra Nevada): Upper Cottonwood Meadows (near Mount Whitney), 12; Independence Creek, 2; Sequoia National Park, 3; Lone Pine, 5.

SOREX (NEOSOREX) ALBIBARBIS (Cope).

Neosorex albibarbis Cope, Proc. Acad. Nat. Sci. Phila., 188–189, 1862.
Sorex albibarbis Merriam, Proc. Biol. Soc. Wash., VII, 25, April, 1892.
Miller, Proc. Bost. Soc. Nat. Hist., XXVII, March 24, 1894.

Type locality.—Profile Lake, Franconia Mountains, New Hampshire.

Geographic distribution.—Boreal parts of eastern North America from mountains of Pennsylvania and New York northward to Labrador.

General characters.—Similar to *S. palustris* in size and general appearance, but with under parts strongly clouded with dusky.

Color.—Upper parts blackish slate very sparingly mixed with light-tipped hairs; chin whitish or grayish, rest of under parts heavily clouded with dusky, the intensity varying with the season. Tail bicolor: blackish above and all round near tip, whitish below on basal half or two-thirds.

Cranial and dental characters.—Skull and teeth similar to those of *S. palustris,* but slightly smaller. The anterior unicuspids are narrower, and the molariform teeth less deeply excavated posteriorly. In size the skull and teeth are intermediate between *palustris* and *navigator*.

Measurements.—Average of 2 specimens from type locality (Profile Lake, New Hampshire): Total length, 153 mm.; tail vertebræ, 66.6 mm.; hind foot, 19 mm. Average of 7 specimens from Elizabethtown, N. Y.: Total length, 154.7 mm.; tail vertebræ, 71.3 mm.; hind foot, 19.3 mm.

General remarks.—In winter pelage the under parts are less clouded than in summer and the resemblance to *S. palustris* is correspondingly closer. The two may be found to intergrade in the region north of Lakes Huron and Superior.

Specimens examined.—Total number, 5, from the following localities:

New Hampshire: Profile Lake (type locality), 1.
New York: Elizabethtown (east side of Adirondacks), 2.
Pennsylvania: Bushkill Creek, Monroe County, 1.
Canada: Godbout, Province of Quebec (north shore of St. Lawrence), 1.

SOREX HYDRODROMUS Dobson.

Sorex hydrodromus Dobson, Annals and Magazine Nat. Hist., 6th ser. IV, 372–374, fig., November, 1889.

Type locality.—Unalaska Island, Aleutian Islands, Alaska.

General characters.—Size small (hind foot, 13 mm.); third incisor larger than fourth; both fore and hind feet fringed on both sides. "A thick comb-like fringe of stiff hairs extends along the outer and inner margins of both manus and pes, being especially dense and well developed along the outer margins."

Color.—"Fur reddish brown above, yellowish brown beneath; chin, throat, and chest with grayish-tipped hairs; the base of the hairs both above and beneath dark bluish gray."[1]

Dental characters.—"The teeth closely resemble those of *S. vulgaris;* as in that species, the third incisor is the largest and longest of the unicuspidate teeth; the first maxillary tooth is very nearly equal to the second incisor and quite intermediate in size between the third incisor and the second maxillary tooth; the third maxillary tooth is even more internal than in *S. vulgaris*, in this respect resembling the American representatives of that species, and its long axis is at right angles to the direction of the jaw, its inner and posterior convex margin fitting into the concavity on the inner and anterior sides of the fourth maxillary tooth. The mandibular teeth closely resemble those of *S. vulgaris*."*

Measurements.—"Length: Head and body, 53 mm.; tail, 46 mm.; eye, from end of muzzle, 9½ mm.; ear, length, 6½ mm.; elbow, to end of middle digit, without claw, 13 mm.; manus, 6 mm.; pes, 13 mm.; distance between tips of first upper incisor and last premolar, 3½ mm."*

General remarks.—This interesting aquatic Shrew was described by Dr. Dobson from a specimen in the Museum of the Imperial Academy of Sciences at St. Petersburg. It is the only American species of the family *Soricidæ* (except *Sorex veræpacis*, from Guatemala) that I have not seen. Its position in the series is uncertain.

---

[1] Dobson, Annals and Magazine Nat. Hist., 6th ser., IV, 373, November, 1889.

Subgenus ATOPHYRAX Merriam, 1884.

Atophyrax Merriam, Trans. Linn. Soc. New York, Vol. II, pp. 217-222, pl. August, 1884. Type, *Atophyrax bendirii* Merriam, from Klamath Basin, Oregon.

Geographic distribution.—The subgenus *Atophyrax* inhabits the northwest coast region from western British Columbia southward to Sonoma County, Calif. In Oregon and Washington it reaches the east base of the Cascade range; in California it is confined, so far as known, to the coast strip north of Point Reyes.

Diagnosis.—Feet large and fimbriate, with third and fourth toes of hind foot webbed at base, as in *Neosorex*. Anterior part of rostrum narrowed, much produced and decurved, forming, with the under jaw, a toothed forceps for seizing living prey. Brain case expanded laterally, as in *Neosorex*. The unicuspidate series are parallel, or nearly parallel, and in the known forms the teeth are narrow and arranged in pairs of approximately equal size—first and second subequal and largest, third and fourth subequal and smaller, the third slightly smaller than fourth. The fifth is large for a Shrew, and when unworn bears a colored cusp, which is sometimes double or bifid. The large antero-internal cusp of m^1 and m^2 rises posteriorly to form a distinct secondary cusp, not present in the other subgenera. This secondary cusp, which is diagnostic of *Atophyrax*, is separated by a sulcus from the large triangular cusp developed on the cingulum of the posterior half of the inner side of the tooth. The extreme of differentiation of the group is exhibited by *A. palmeri*, from the mouth of the Columbia River.

Number of representatives.—Three well-marked forms of *Atophyrax* are contained in the Department collection: (1) *A. bendirii*, ranging from Burrard Inlet, British Columbia, southward along the Cascade range to southern Oregon, and thence southwesterly to and along the coast of northern California; (2) *palmeri*, from the coast of Oregon at the mouth of the Columbia River; and (3) *albiventer*, from the Olympic Mountains of Washington. Still another may require subspecific recognition, namely, a form from the coast of California in Mendocino County. Additional material is necessary to determine the interrelations of the several forms.

SOREX (ATOPHYRAX) BENDIRII (Merriam).

(Pl. X, figs. 1–4.)

Atophyrax bendirii Merriam, Trans. Linn. Soc. New York, II, 217-225, Aug., 1884.
Sorex bendirii Dobson, Mon. Insectivora, Part III, fasc. 1, Pl. XXIII, fig. 17, and explanation (type specimen).

Type locality.—Klamath Basin, Oregon (near Williamson River, 18 miles southeast of Fort Klamath).

Geographic distribution.—Klamath Basin, Oregon, and thence northward along east side of Cascade range to Puget Sound (Port Moody, British Columbia); westward (probably through Klamath River Valley) to coast of California, and southward to Sonoma County.

General characters.—Size, large (total length, 150 mm.; head and body, 82 mm.; hind foot, 20 mm.); tail long; coloration uniform sooty or sooty brown, sometimes paler below.

Color.—Dull sooty plumbeous, changing in worn pelage to sooty brown, faintly paler on under parts; tail dusky all round. Some of the specimens from Easton and Port Moody have the under parts decidedly pale, suggesting a seasonal difference.

Cranial and dental characters.—The characters by which *Atophyrax* differs from *Sorex* and *Neosorex* have been given in the subgeneric diagnosis and need not be repeated here. The skull of *S. bendirii* differs from those of *palmeri* and *albiventer*, the only other members of the subgenus now known, in the following particulars: Size smaller (total length, 22.5 mm.); anterior narrow part of rostrum shorter; brain case shorter; interpterygoid notch broader; unicuspidate series slightly more divergent posteriorly; molars narrower.

Measurements.—Type specimen (measured from alcohol, in good condition): Total length, 150 mm.; tail vertebræ, 68 mm.; hind foot, 20 mm. Average of 3 specimens from Mendocino County, Calif. (measured in flesh): Total length, 150.3 mm; tail vertebræ, 69.7 mm.; hind foot, 19.7 mm.

General remarks.—The type of *Atophyrax bendirii* was collected in Klamath Basin, Oregon, by Capt. (now Major) C. E. Bendire, and was described by me eleven years ago. The next specimens examined were from Chilliwack, British Columbia, collected by Mr. A. C. Brooks. Subsequently the field naturalists of the division extended the range of the species southward along the coast of California to Gualala, and northward along the Cascade range to Port Moody, on Burrard Inlet, British Columbia. Two additional forms, believed to intergrade with *bendirii*, and hence treated as subspecies, have been discovered and are here described: *palmeri*, a large black form from the coast of Oregon at Astoria; and *albiventer*, a white-bellied form from the Olympic Mountains of Washington. In addition to these, the form from Gualala, Calif., differs somewhat from typical *bendirii*, and if the characters shown by the only two specimens at hand prove constant, will also merit subspecific separation. The two specimens referred to differ from all other American Shrews in having the fifth unicuspidate tooth unusually large and with a double cusp. The peculiarity would seem to be abnormal, but is constant in the two specimens examined. The unicuspidate teeth are more crowded, so that the series as a whole is shorter and the cingulum does not reach so far backward. The large upper premolar and first true molar are more deeply excavated posteriorly, and the third and fourth unicuspids larger.

Specimens examined.—Total number, 21, from the following localities:

British Columbia: Port Moody, 7; Chilliwack, 2.
Washington: Easton (Cascade range), 8.
Oregon: Klamath Basin, 1 (type).
California: Mendocino County, 1; Gualala, 2.

SOREX (ATOPHYRAX) BENDIRII PALMERI subsp. nov.

(Pl. XII, figs. 1–3.)

Type from Astoria, Oregon. Type No. $\frac{17338}{24263}$, ♀ old, U. S. Nat. Mus., Department of Agriculture collection. Collected July 29, 1889, by T. S. Palmer. Orig. No. 256.

Geographic distribution.—Coast of Oregon and Willamette Valley; limits of range unknown.

General characters.—Similar to *S. bendirii*, but larger (total length, 165 mm.; head and body, 92 mm.); blacker; skull heavier.

Color.—Upper parts glossy black, changing gradually to sooty plumbeous on under parts; tail dusky all round. The black of the upper parts is less pure on the head and shoulders, where the brownish subapical part of the fur shows through.

Cranial and dental characters.—Contrasted with *S. bendirii* the skull of *palmeri* is larger and heavier (type measures 24.5 by 11.5 mm.), with narrower interpterygoid fossa, and larger and heavier teeth. The unicuspids and molars are relatively as well as actually broader. The first unicuspid is appreciably larger than second; third and fourth subequal, but third slightly the smaller. Unicuspid series with middle incisor longer than molariform series.

Measurements.—Type specimen: Total length, 165 mm.; tail vertebræ, 73 mm.; hind foot, 20 mm.

General remarks.—A specimen from Beaverton, in the Willamette Valley, is practically indistinguishable from the type, but one from Oregon City (collected October 21) is more dark slate color without pure black.

Specimens examined.—Total number, 3, from the following localities in Oregon: Astoria (type locality), 1; Beaverton, 1; Oregon City, 1.

SOREX (ATOPHYRAX) BENDIRII ALBIVENTER subsp. nov.

Type from Lake Cushman, Olympic Mountains, Washington. Type, No. 66198, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected July 7, 1894, by C. P. Streator. Original number, 4021.

General characters.—Similar to *S. bendirii*, but larger, with tail decidedly longer, and under parts abruptly whitish; skull and teeth larger.

Color.—Upper parts sooty plumbeous; under parts abruptly white or whitish (as in *Neosorex*), clouded with dusky on breast and middle of belly. In one pelage the clouding below spreads over nearly the whole of the under parts. Tail blackish, indistinctly and narrowly paler below basally.

Cranial and dental characters.—Skull decidedly larger than *bendirii* (23.5 by 10.5. mm.); molariform teeth about the same size; unicuspidate teeth less crowded and series longer; second unicuspid smaller than first. The skull is intermediate in size between *bendirii* and *palmeri.*

Measurements.—Type specimen: Total length, 166 mm.; tail vertebræ, 78 mm.; hind foot, 20.5 mm. Average of 3 specimens from type locality (Lake Cushman, Washington): Total length, 160.3 mm.; tail vertebræ, 73.3 mm.; hind foot, 20.5 mm. One of these has a short tail. The average of the other 2 is: Total length, 165 mm.; tail vertebræ, 78 mm.; hind foot, 21 mm.

General remarks.—So far as known *albiventer* is restricted to the Olympic Mountains. Its large feet indicate that it is more aquatic than the other members of the group. The white of the under parts is much more marked than in the Easton and Port Moody specimens of *bendirii*, and the tail is considerably longer.

ADDENDUM.

While this paper is passing through the press, a remarkable new species of *Sorex* proper has been received from southern Mexico, and is here described.

SOREX STIZODON sp. nov.

Type from San Cristobal, Chiapas, Mexico, No. 75885, ♀ ad. U. S. Nat. Museum, Dept. of Agriculture Coll. Collected Sept. 25, 1895, by E. W. Nelson and E. A. Goldman. Orig. No. 8473.

General characters.—Similar to *S. saussurei* in external appearance, but slightly smaller, and rump not decidedly darker than rest of back.

Color.—Upper parts finely mixed sepia brown and dusky; under parts seal brown, passing insensibly into color of sides and back; tail indistinctly bicolor, dusky above, pale below.

Cranial and dental characters.—Skull similar to that of *saussurei* in general form, great breadth of constriction and breadth of palate; but shorter and broader, with brain case more inflated and rostrum shorter. First and second unicuspids large, the second much larger than first and relatively larger than in any other member of the genus known to me. Contrasted with *saussurei* the molariform teeth are decidedly smaller and less emarginate posteriorly. The chestnut tips to all the teeth are reduced to a minimum and very pale.

Measurements.—The flesh measurements have not been received from the collector. The skin measures as follows: Total length, 105; tail vertebræ, 38; hind foot, 12.

INDEX.

[Names of synonyms are in italics.]

Anotus, 9.
Amphisorex lesueuri, 53, 60.
Atophyrax, 95.
    albiventer, 97–98.
    bendirii, 95–97.
    palmeri, 97.
Blaria, 9.
Blarina, genus, 5.
    characters, 5–8.
    geographic distribution, 8.
    history and nomenclature, 5.
    list of species, 8.
    number of specimens examined, 9.
    subdivisions, 6.
    subgenus, 9–10.
        key to species, 10.
    table of flesh measurements, 29.
    table of cranial measurements, 30.
Blarina alticola, 27–28.
    angusticeps, 6, 10.
    berlandieri, 20.
        history, 6, 7.
    brevicauda, 10–13.
        history, 6.
    carolinensis, 13–14.
        history, 6.
    cinereus, 6.
    costaricensis, 7, 10, 12.
    dekayi, 6.
    exilipes, 6, 7, 17.
    eximius, 7, 17.
    floridana, 19.
    fossor, 28.
    goldmani, 25.
    machetes, 26.
    magna, 28–29.
    mexicana, 23–24.
        history, 7.
    micrura, 7, 21.
    nelsoni, 26–27.
    nigrescens, 8, 31.
    obscura, 23.
    orophila, 8, 30.
    parva, 17–18.
        history, 6–7.
    peninsulæ, 14–15.
    peregrina, 24–25.
    soricina, 22–23.
    talpoides, 6, 10.
    telmalestes, 15–16.
    tropicalis, 21–22.
Brachysorex, 9.
Corsira, 10.
Corsira tropicalis, 21.
    talpoides, 10.
Cryptotis, subgenus, 16.
    key to species, 17.
    list of species, 8.
Galemys, 9.
Hydrogale, 41.
Microsorex, 42, 43, 89.
    hoyi, 43–45, 89–90.
Neosorex, 45, 90–91.
    albibarbis, 46, 93–94.
    hydrodromus, 94.
    navigator, 45, 92–93.
    palustris, 46, 91–92.
Notiosorex, genus, 31.
    history and nomenclature, 32.
    geographic distribution, 31.
Notiosorex crawfordi, 32–33.
    crawfordi evotis, 34.
Otisorex platyrhinus, 39, 53, 60.
Sorex, genus.
    araneus group, 48.
    key to Mexican species, 60.
    key to United States species, 59.
    key to species of eastern United States, 42.
    longirostris group, 48.
    list of species, 58.
    minutus group, 48.
    pelages, 57.
    subgenus, 48.
    table of cranial measurements, 56.
Sorex alascensis, 76.
    albibarbis, 46–47, 93–94.
        history, 37.
    albiventer, 97–98.
    amœnus, 67–70.
    araneus, 48, 49, 50.
    bairdi, 77–78.
    bendirii, 95–96.
    brevicauda, 10.
    californicus, 80.
    carolinensis, 13.
    caudatus, 84–85.
    cinereus, 17.
    cooperi, 41, 53, 60.
    crawfordi, 32.
    dekayi, 10.
    dobsoni, 68–69.
    evotis, 34.

Sorex *fimbripes*, 41, 53.
  fisheri, 86.
  forsteri, 40, 41, 50, 53, 60.
  fumeus, 50-52, 65-66.
    history, 38.
  haydeni, 41, 53, 56, 60, 61.
  hoyi, 43-45, 89-90.
    history, 36.
  hydrodromus, 94.
  idahoensis, 41, 54, 60.
  lesueuri, 61.
  longicauda, 74.
  longirostris, 52-53, 85.
    history, 40.
  macrodon, 82.
  merriami, 88-89.
  micrurus, 21.
  minutus, 54, 55.
  montereyensis, 79.
  monticola, 69.
  nanus, 81-82.
  navigator, 92-93.
  nevadensis, 71.
  obscurus, 72-73.
  oreopolus, 77.
  orizabæ, 71.
  ornatus, 79-80.
  pachyurus, 38, 48.
  pacificus, 86-87.

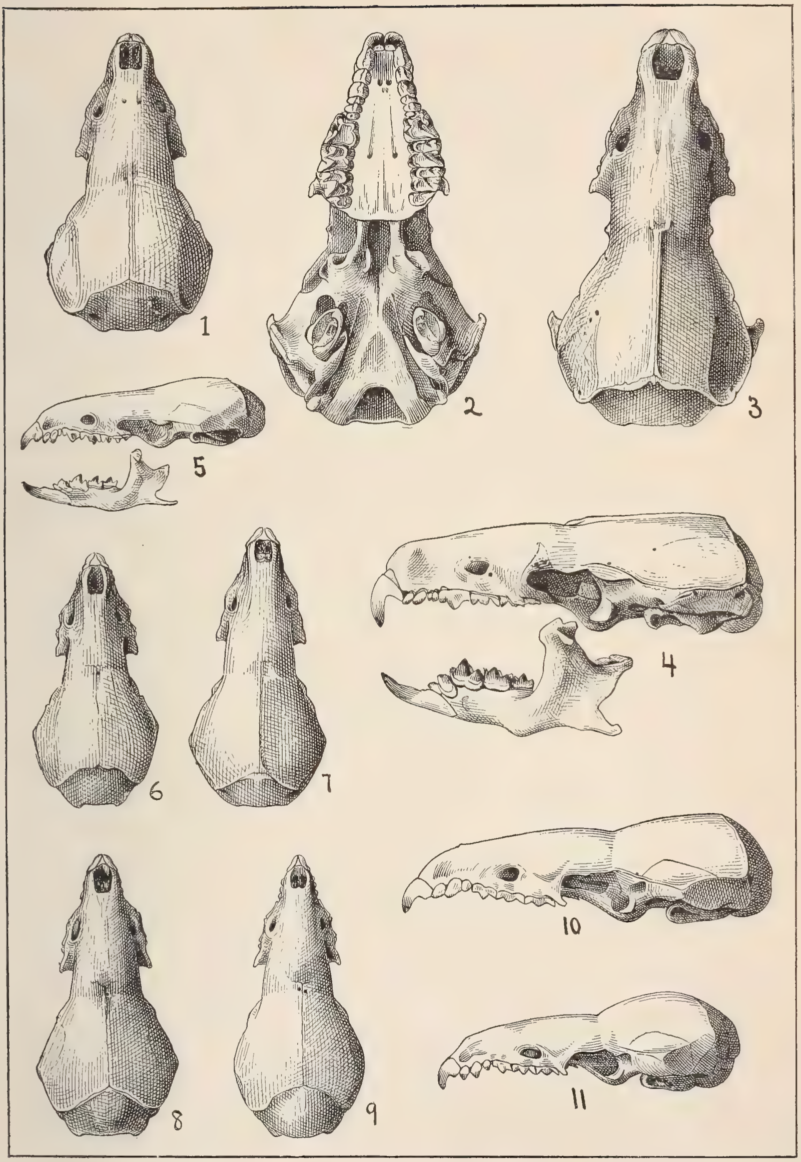
Sorex palmeri, 97.
  palustris, 45-46, 91-92.
    history, 36.
  parvus, 17, 38, 48.
  personatus, 52, 53-56, 60-62.
    history, 40.
    table of measurements, 63.
  platyrhinchus, 60.
  platyrhinus, 60, 65.
  pribilofensis, 87.
  richardsoni, 48-50, 54, 63-64.
    history, 38.
  saussurei, 83.
  similis, 72.
  sphagnicola, 64-65.
  stizodon, 98.
  streatori, 62-63.
  suckleyi, 67.
  talpoides, 10.
  tenellus, 81.
  thompsoni, 36, 43, 89.
  trowbridgii, 78.
  vagrans, 67-68.
  vancouverensis, 70.
  ventralis, 75.
  veræpacis, 82.
  vulgaris, 48.
Soriciscus, 30.
Talposorex, 9.

PLATE I.

[All double natural size.]

FIG. 1. *Blarina carolinensis* (Bach). Columbia, S. C.
(No. 71471, U. S. Nat. Mus.)
2–4. *Blarina brevicauda* (Say). Blair, Nebr. (type locality).
(No. 48830, U. S. Nat. Mus.)
5–6. *Blarina parva* (Say). Blair, Nebr.
(No. 48025, U. S. Nat. Mus.)
7. *Blarina floridana* nob. Canaveral, Fla.
(No. 23937, U. S. Nat. Mus.)
8. *Blarina tropicalis.* Pluma, Oaxaca, Mexico.
(No. 71452, U. S. Nat. Mus.)
9. *Blarina soricina* nob. Tlalpam, Valley of Mexico.
(No. 50761, U. S. Nat. Mus.)
10. *Blarina magna* nob. Totontepec, Oaxaca, Mexico.
(No. 68575, U. S. Nat. Mus.)
11. *Blarina mexicana* Baird. Jico, Vera Cruz, Mexico.
(No. 55083, U. S. Nat. Mus.)

PLATE I.



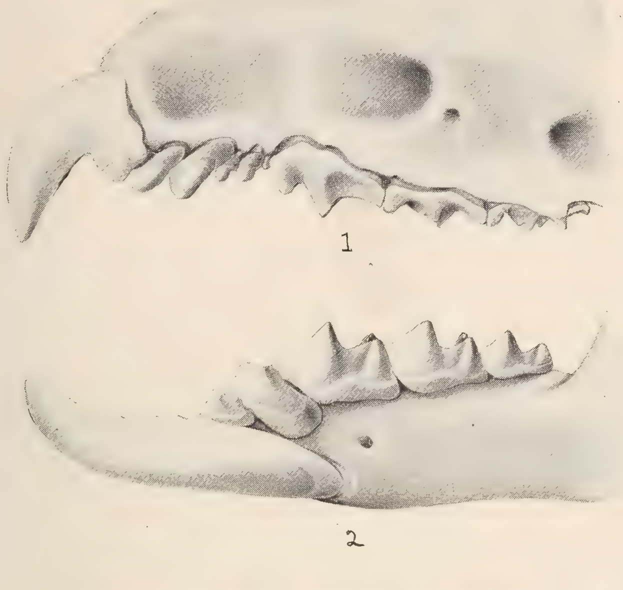
1. *Blarina carolinensis.*
2–4. *B. brevicauda.*
5, 6. *B. parva.*
7. *B. floridana.*
8. *B. tropicalis.*
9. *B. soricina.*
10. *B. magna.*
11. *B. mexicana.*

PLATE II.

[Enlarged about seven times.]

FIG. 1-4. *Blarina brevicauda* (Say). Council Bluffs, Iowa (near type locality).
(No. 43765, ♀ ad., U. S. Nat. Mus.)
1. Left side of upper jaw, showing teeth.
2. Left side of under jaw.
3. Lower series of teeth, showing crowns (left side).
4. Upper series of teeth, showing crowns (left side).

5. *Blarina telmalestes* nob. Dismal Swamp, Virginia. Type.
(No. 71823, ♀ ad., U. S. Nat. Mus.)
Upper series of teeth, showing crowns (left side).

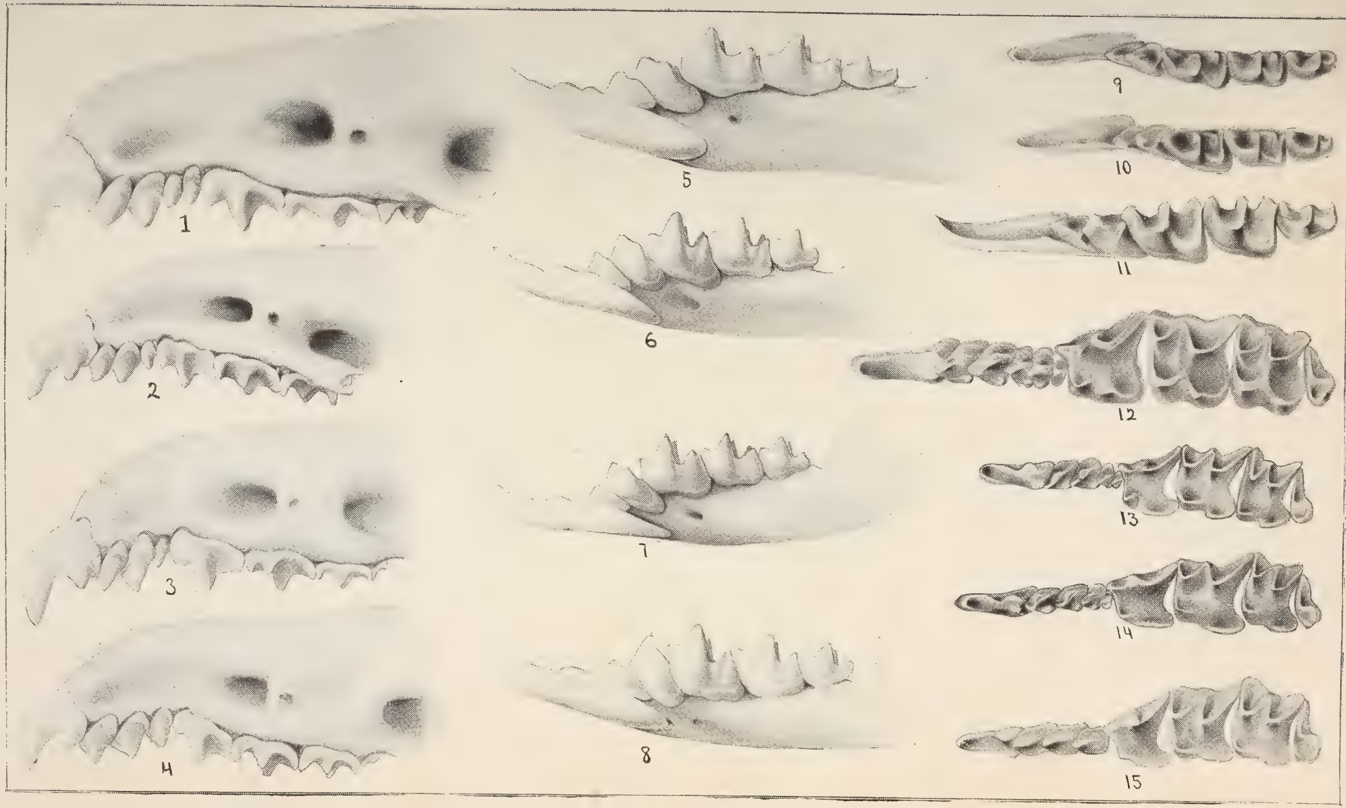


1-4. *Blarina brevicauda* (Say). Council Bluffs, Iowa.
5. *B. telmalestes* nob. Dismal Swamp, Va.

PLATE III.

[Enlarged about seven times.]

FIGS. 1, 5, 11, 12. *Blarina carolinensis.* Raleigh, N. C.
(No. 3610, U. S. Nat. Mus.)
2, 6, 9, 13. *Blarina parva.* Blair, Nebr.
(N. 48823, U. S. Nat. Mus.)
3, 7, 10, 14. *Blarina berlandieri.* Brownsville, Tex.
(No. 48810, U. S. Nat. Mus.)
4, 8, 15. *Notiosorex crawfordi.* San Bernardino, Cal.
(No. 2661, Merriam collection.)



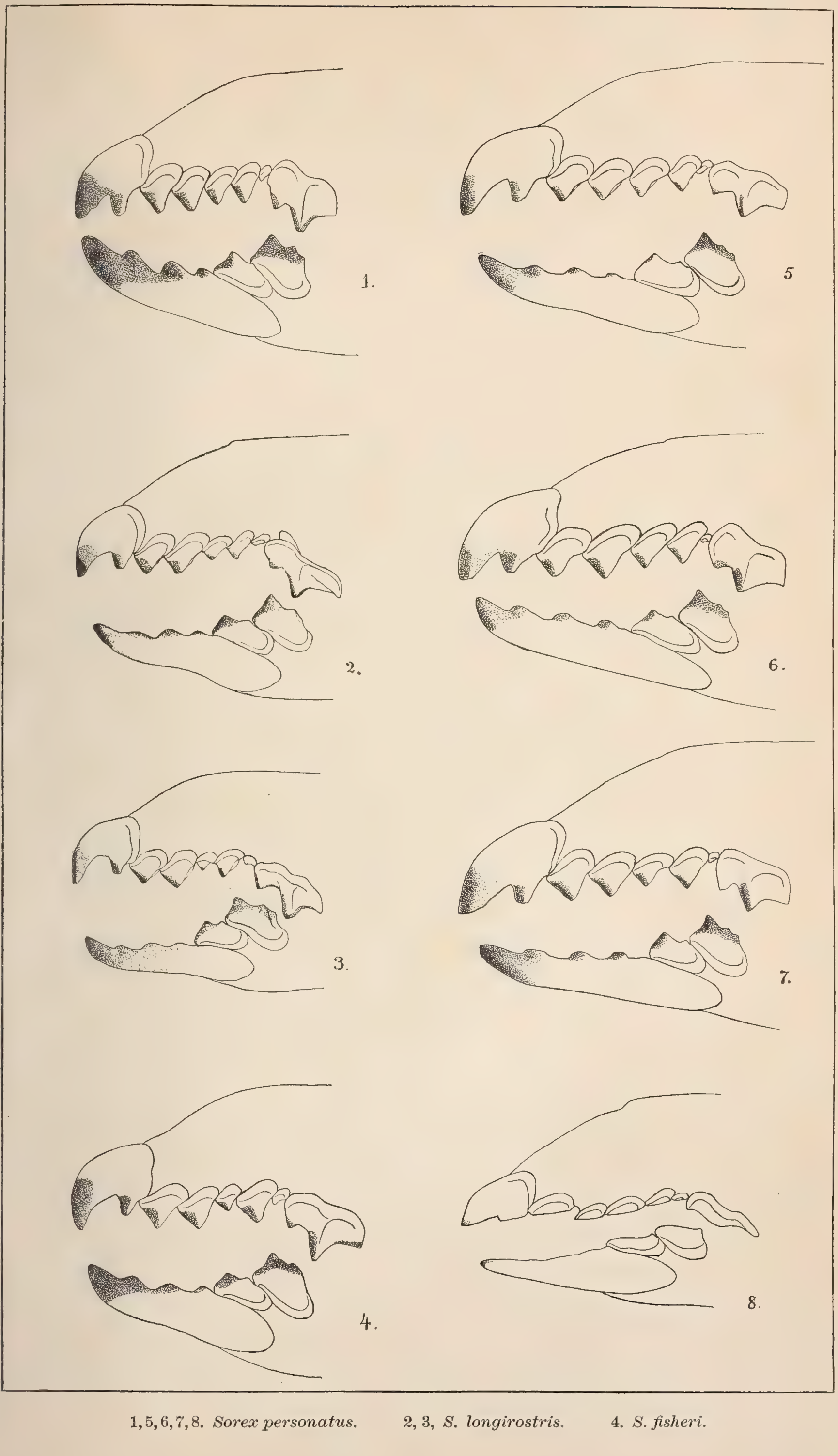
1, 5, 11, 12. *Blarina carolinensis.* 2, 6, 9, 13. *B. parva.* 3, 7, 10, 14. *B. berlandieri.* 4, 8, 15. *Notiosorex crawfordi.*

PLATE IV.

[All magnified above ten diameters.]

FIG. 1. *Sorex personatus.* Osler, Saskatchewan, Canada.
(Collection of E. A. and O. Bangs.)
2. *Sorex longirostris.* Raleigh, N. C.
(No. 1280, collection of G. S. Miller, jr.)
3. *Sorex longirostris.* Raleigh, N. C.
(No. 1297, collection of G. S. Miller, jr.)
4. *Sorex fisheri.* Dismal Swamp, Virginia.
(No. 71822, U. S. Nat. Mus., Department of Agriculture collection.)
5. *Sorex personatus.* Victoria County, New Brunswick.
(No. 8035, Am. Mus. Nat. Hist.)
6. *Sorex personatus.* Victoria County, New Brunswick.
(No. 7994, Am. Mus. Nat. Hist)
7. *Sorex personatus.* Victoria County, New Brunswick.
(No. 8022, Am. Mus. Nat. Hist.)
8. *Sorex personatus.* Nantucket, Mass.
(No. 2153, collection of G. S. Miller, jr. Teeth very much worn.)

PLATE IV.

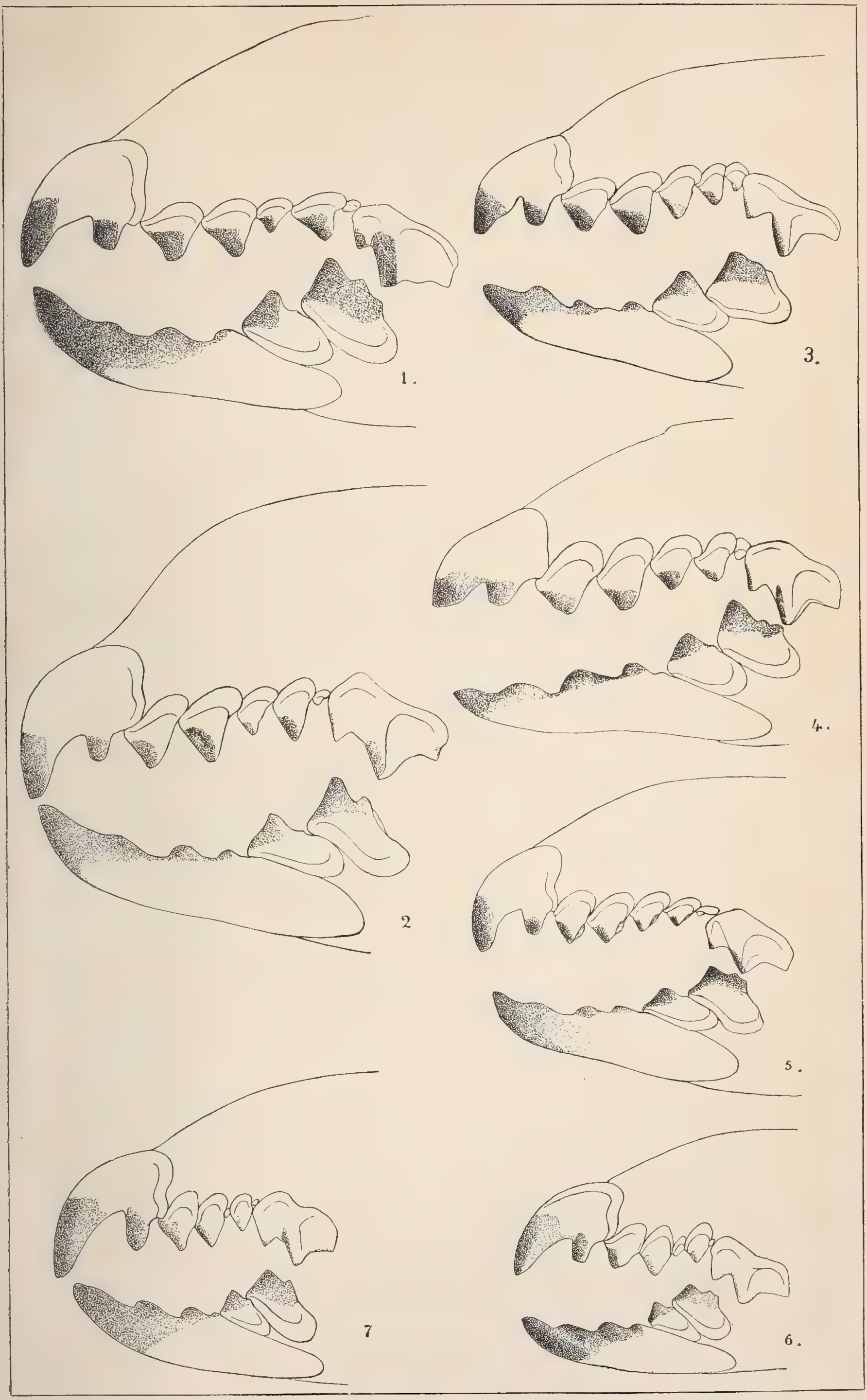


1, 5, 6, 7, 8. *Sorex personatus.* 2, 3, *S. longirostris.* 4. *S. fisheri.*

PLATE V.

[All magnified about ten diameter

FIG. 1. *Sorex palustris.* Laramie, Wyo.
(No. 54595, U. S. Nat. Mus., Department of Agriculture collection.)
2. *Sorex albibarbis.* Elizabethtown, N. Y.
(No. 2428, collection of G. S. Miller, jr.)
3. *Sorex araneus.* Scotland.
(No. 3598, collection of G. S. Miller, jr.)
4. *Sorex richardsoni.* Elk River, Minnesota.
(No. 2563, collection of Dr. C. Hart Merriam.)
5. *Sorex fumeus* sp. nov. Peterboro, N. Y.
(Type, No. 2582, collection of G. S. Miller, jr.)
6. *Sorex hoyi.* Victoria County, New Brunswick.
(No. 8005, Am. Mus. Nat. Hist.)
7. *Sorex hoyi.* Elk River, Minnesota.
(No. 4353, collection of Dr. C. Hart Merriam.)

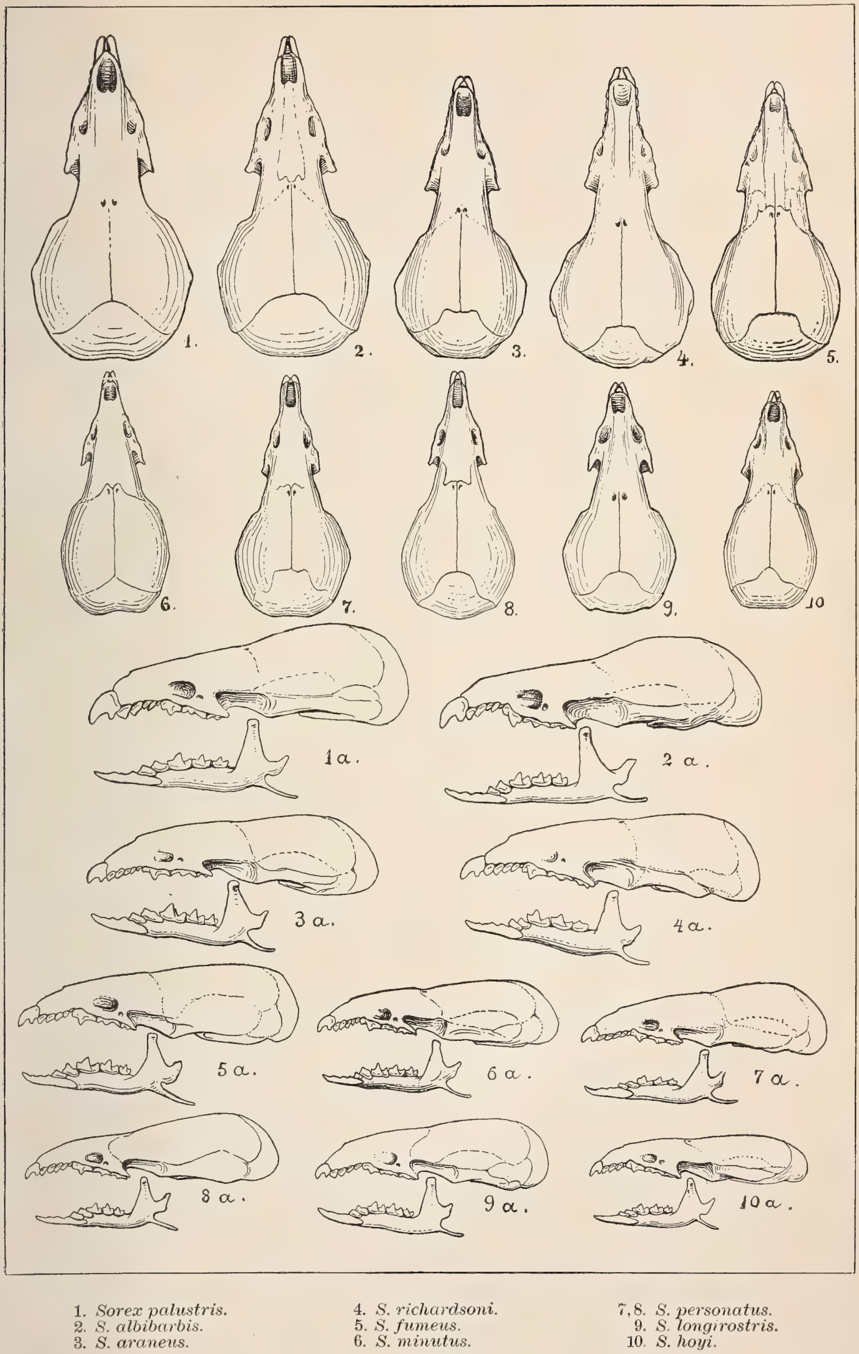


1. *Sorex palustris.*
2. *S. albibarbis.*
3. *S. araneus.*
4. *S. richardsoni.*
5. *S. fumeus.*
6, 7. *S. hoyi.*

PLATE VI.

[All double natural size.]

FIG. 1. *Sorex palustris.* Laramie, Wyo.
(No. 54595, U. S. Nat. Mus., Department of Agriculture collection.)
2. *Sorex albibarbis.* Elizabethtown, N. Y.
(No. 2428, collection of G. S. Miller, jr.)
3. *Sorex araneus.* New Forest, England.
(No. 2852, collection of G. S. Miller, jr.)
4. *Sorex richardsoni.* Elk River, Minnesota.
(No. 2547, collection of Dr. C. Hart Merriam.)
5. *Sorex fumeus* sp. nov. Peterboro, N. Y.
(Type, No. 2582, collection of G. S. Miller, jr.)
6. *Sorex minutus.* Clifton, England.
(No. 3604, collection of G. S. Miller, jr.)
7. *Sorex personatus.* Mount Graylock, Massachusetts.
(No. 2303, collection of G. S. Miller, jr.)
8. *Sorex personatus.* South Edmonton, Alberta.
(No. 69170, U. S. Nat. Mus., Department of Agriculture collection.)
9. *Sorex longirostris.* Raleigh, N. C.
(No. 1128, collection of G. S. Miller, jr.)
10. *Sorex hoyi.* Locust Grove, N. Y.
(No. 4857, collection of Dr. C. Hart Merriam.)

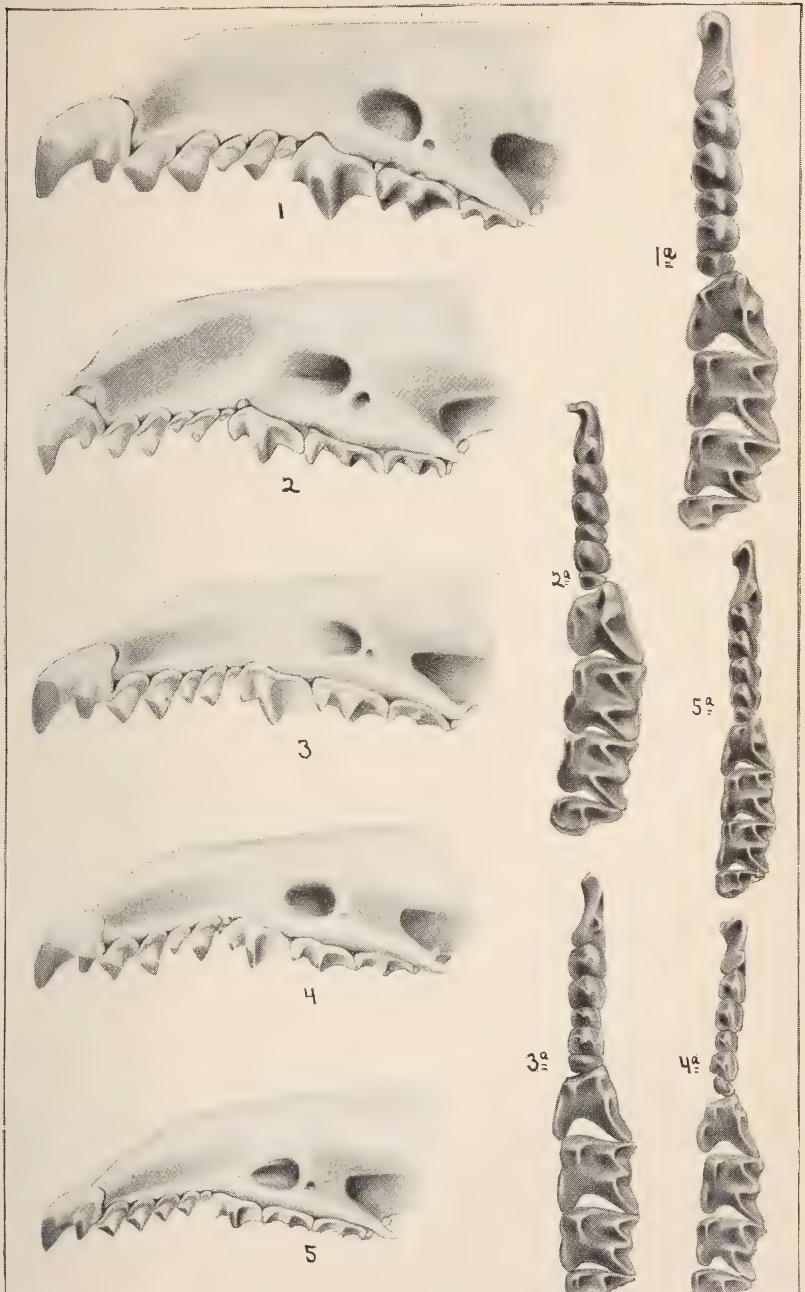


1. *Sorex palustris.*
2. *S. albibarbis.*
3. *S. araneus.*
4. *S. richardsoni.*
5. *S. fumeus.*
6. *S. minutus.*
7, 8. *S. personatus.*
9. *S. longirostris.*
10. *S. hoyi.*

PLATE VII.

[Enlarged about seven times.]

FIG. 1. *Sorex pacificus.* Crescent City, Calif.
(No. 24011, U. S. Nat. Mus.)
2. *Sorex macrodon* nob. Orizaba, Mexico. Type
(No. 58272, U. S. Nat. Mus.)
3. *Sorex bairdi* nob. Astoria, Oreg.
(No. 24318, U. S. Nat. Mus.)
4. *Sorex trowbridgii.* Astoria, Oreg.
(No. 24315, U. S. Nat. Mus.)
5. *Sorex personatus.* South Edmonton, Alberta.
(No. 69169, U. S. Nat. Mus.)

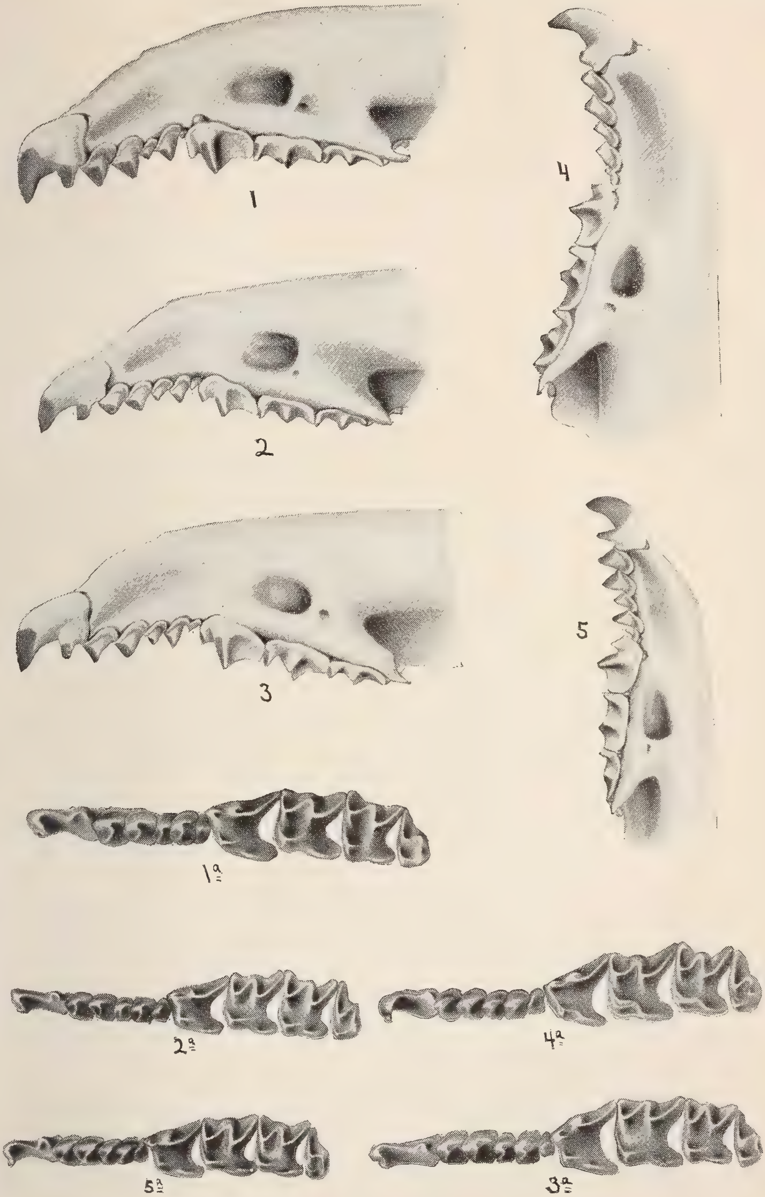


1. *Sorex pacificus.*
2. *S. macrodon.*
3. *S. bairdi.*
4. *S. trowbridgii.*
5. *S. personatus.*

PLATE VIII.

[Enlarged about seven times.]

FIG. 1. *Sorex obscurus.* Salmon River Mountains, Idaho. [Type of *S. similis.*]
(No. 23525, ♀, U. S. Nat. Mus.)
2. *Sorex vagrans.* Aberdeen, Wash.
(No. 24322, U. S. Nat. Mus.)
3. *Sorex ornatus* nob. San Emigdio Canyon, California. Type.
(No. 43198, ♂ ad., U. S. Nat. Mus.)
4. *Sorex oreopolus.* Sierra Nevada de Colima, Jalisco, Mexico. Type.
(No. 45698, U. S. Nat. Mus.)
5. *Sorex tenellus nanus* nob. Estes Park, Colorado. Type.
(No. 73772, U. S. Nat. Mus.)



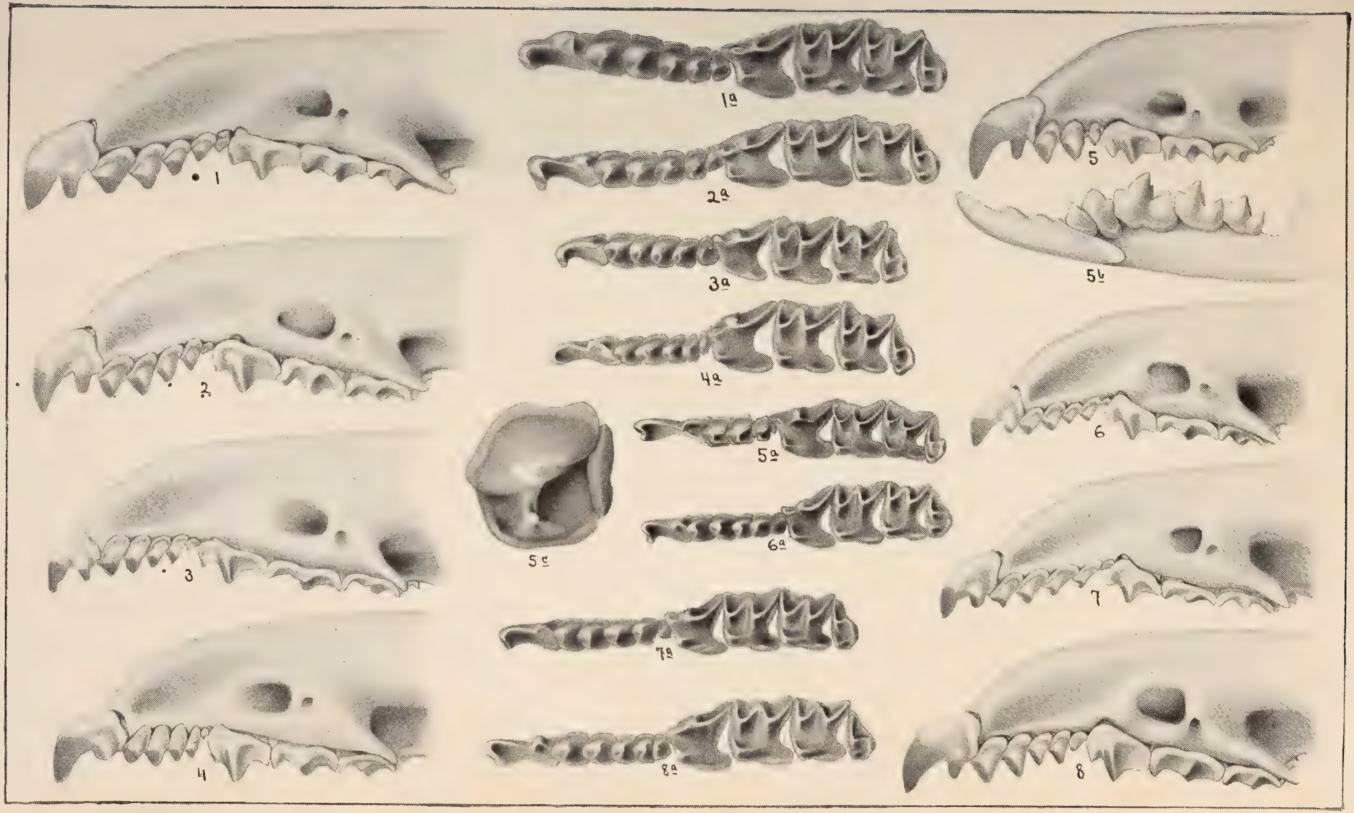
1. *Sorex obscurus.*
2. *S. vagrans.*
3. *S. ornatus.*
4. *S. oreopolus.*
5. *S. nanus.*

PLATE IX.

[Enlarged about seven times.]

FIG. 1. *Sorex richardsoni.* Edmonton, Alberta, Canada.
(No. 69156, U. S. Nat. Mus.)
1. Upper jaw with teeth (profile).
1*a*. Crowns of upper series of teeth.
2. *Sorex fumeus.* Lake George, New York.
(No. 55945, ♂, U. S. Nat. Mus.)
2. Upper jaw with teeth (profile).
2*a*. Crowns of upper series of teeth.
3. *Sorex pribilofensis.* St. Paul Island, Pribilof Islands, Bering Sea.
(No. 74657, U. S. Nat. Mus.)
3. Upper jaw with teeth (profile).
3*a*. Crowns of upper series of teeth.
4. *Sorex merriami.* Fort Custer, Mont. Type.
(No. 4861, ♀, Merriam collection.)
4. Upper jaw with teeth (profile).
4*a*. Crowns of upper series of teeth.
5. *Microsorex hoyi.* Devils Lake, N. Dak.
(No. 4353, Merriam collection.)
5. Upper jaw (profile).
5*a*. Crowns of upper series of teeth.
5*b*. Lower jaw (profile).
5*c*. Second and third unicuspids greatly enlarged.
6. *Sorex longirostris.* Raleigh, N. C.
(No. 4635, ♀, Merriam collection.)
6. Upper jaw with teeth (profile).
6*a*. Crowns of upper series of teeth.
7. *Sorex personatus.* Montauk Point, New York.
(No. 56588, U. S. Nat. Mus.)
7. Upper jaw with teeth (profile).
7*a*. Crowns of upper series of teeth.
8. *Sorex dobsoni.* Alturas Lake, Idaho. Type.
(No. 31678, U. S. Nat. Mus.)
8. Upper jaw with teeth.
8*a*. Crowns of upper series of teeth.

NOTE.—In this specimen the third unicuspid is abnormally lar



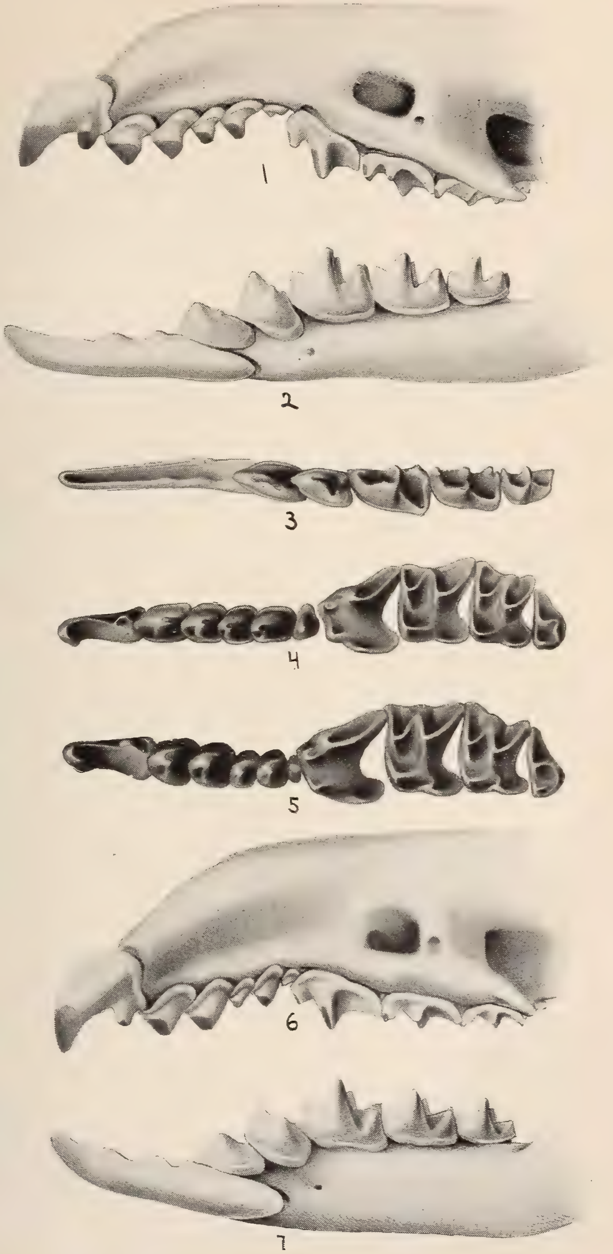
1. *Sorex richardsoni.* 2. *S. fumeus.* 3. *S. pribilofensis.* 4. *S. merriami.* 5. *S. hoyi.* 6. *S. longirostris.* 7. *S. personatus.* 8. *S. dobsoni.*

PLATE X.

[Enlarged about seven times.]

FIGS. 1–4. *Sorex* (*Atophyrax*) *bendirii*. Easton, Wash.
- 1. Upper jaw (profile).
- 2. Lower jaw (profile).
- 3. Crowns of lower series of teeth.
- 4. Crowns of upper series of teeth.

5–7. *Sorex* (*Neosorex*) *palustris*. Elk River, Minn.
- 5. Crowns of upper series of teeth.
- 6. Upper jaw (profile).
- 7. Lower jaw (profile).



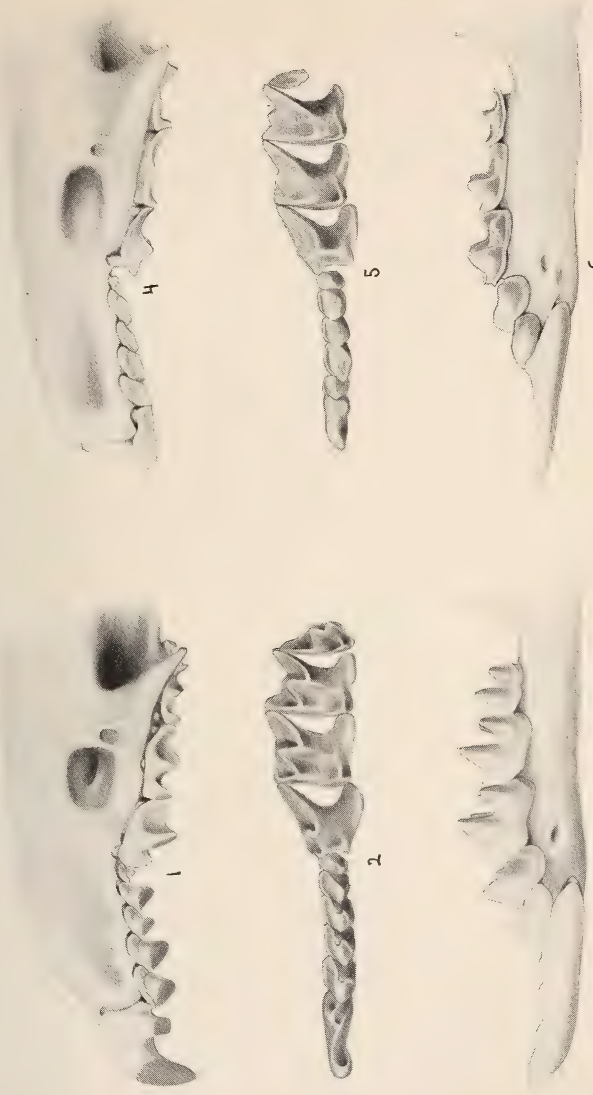
1-4. *Sorex* (*Atophyrax*) *bendirii*. Easton, Wash.
5-7. *Sorex* (*Neosorex*) *palustris*. Elk River, Minn.

PLATE XI.

[Enlarged about seven times.]

Sorex (Neosorex) navigator. Mount Whitney, California. Showing changes in teeth resulting from wear.

FIGS. 1–3. Young adult (No. 42412).
4–6. Very old (No. 42413).
1 and 4. Upper jaw (profile).
2 and 5. Crowns of upper series of teeth.
3 and 6. Lower jaw (profile)

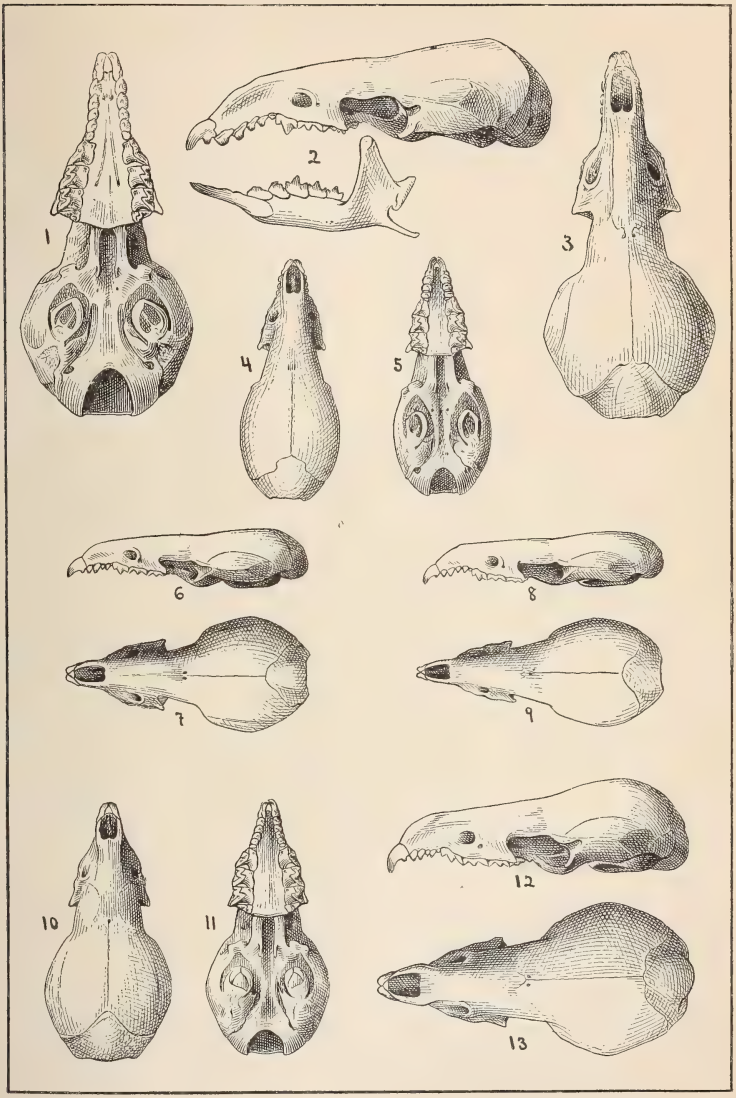


Sorex palustris navigator, showing changes in teeth resulting from wear. Specimens from Mount Whitney, California.
1–3. Young adult. 4–6. Very old.

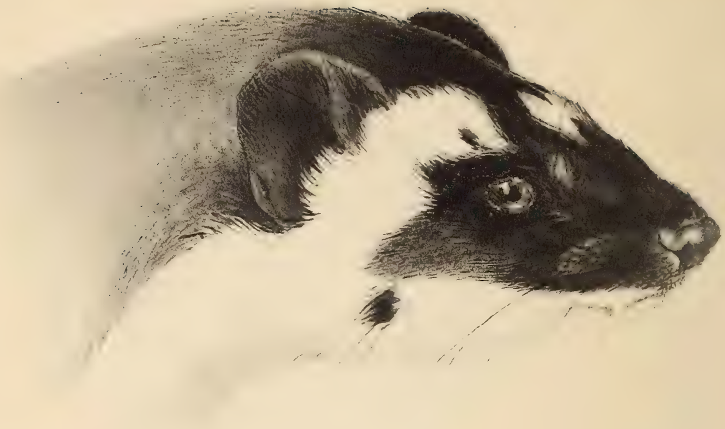
PLATE XII.

[All double natural size.]

FIGS. 1- 3. *Sorex* (*Atophyrax*) *bendirii palmeri*. Oregon City, Oregon. Type.
(No. 56898, U. S. Nat. Mus.)
4- 5. *Sorex* (*Microsorex*) *hoyi*. Elk River, Minn.
(No. 2520, Merriam collection.)
6- 7. *Sorex californicus*. Walnut Creek, Contra Costa County, Calif.
(No. 44428, U. S. Nat. Mus.)
8- 9. *Sorex tenellus*. Lone Pine, Owens Valley, California. Type.
(No. 32495, U. S. Nat. Mus.)
10–11. *Sorex merriami*. Fort Custer, Mont. Type.
(No. 4861, ♀, Merriam collection.)
12–13. *Sorex macrodon*. Orizaba, Vera Cruz, Mexico. Type.
(No. 58272, ♂, U. S. Nat. Mus.)

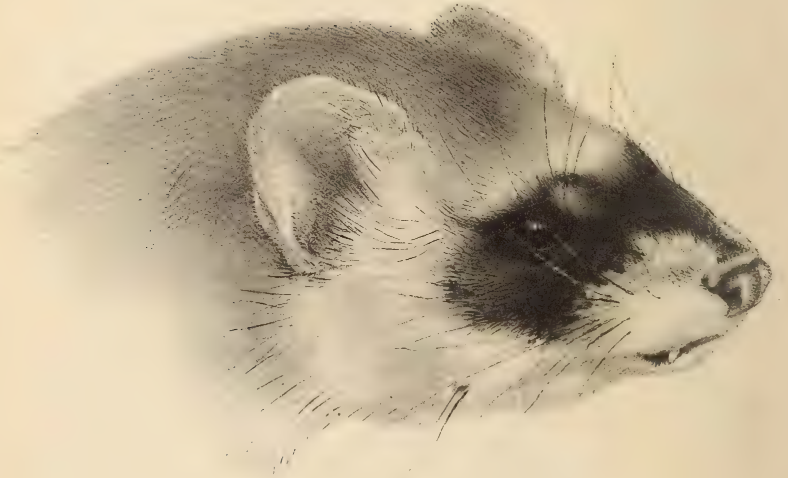


1–3. *Sorex bendirii palmeri.*
4, 5. *S. hoyi.*
6, 7. *S. californicus.*
8, 9. *S. tenellus.*
10, 11. *S. merriami.*
12, 13. *S. macrodon.*



Bridled Weasel, Putorius frenatus.

Valley of Mexico.



Black-footed Ferret, Putorius nigripes.

Western Kansas.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 11

[Actual date of publication June 30, 1896]

SYNOPSIS OF THE WEASELS OF NORTH AMERICA

C. HART MERRIAM

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
Washington, D. C., May 9, 1896.

SIR: I have the honor to transmit herewith for publication, as No. 11 of North American Fauna, a Synopsis of the Weasels of North America.

Respectfully,
C. HART MERRIAM,
Chief of Division of Ornithology and Mammalogy.

Dr. CHAS. W. DABNEY, Jr.,
Acting Secretary of Agriculture.

CONTENTS.

Page.
Introduction 5–7
Subgenus *Putorius* (the ferrets) 7–9
Subgenus *Ictis* (the weasels) 9
List of North American weasels 10
Descriptions of species 10–32
Table of cranial measurements 33

ILLUSTRATIONS.

(All natural size.)

PLATES.

Frontispiece. Heads of Black-footed Ferret and Bridled Weasel.
1. Skulls of *Putorius nigripes* and *P. putorius*.
2. Skulls of *Putorius arcticus, alascensis, cicognani, streatori,* and *rixosus*.
3. Skulls of *Putorius frenatus, longicauda,* and *tropicalis*.
4. Skulls of *Putorius noveboracensis, washingtoni,* and *peninsulæ*.
5. Skulls of *Putorius longicauda, cicognani, noveboracensis, rixosus, peninsulæ,* and *arcticus*.

TEXT FIGURES.

1. *Putorius nigripes,* ♂ old. Trego County, Kans.
2, 3. *Putorius cicognani,* ♂ ad. Elk River, Minnesota.
4–6. *Putorius noveboracensis,* ♂ ad. Adirondacks, New York.
7–9. *Putorius longicauda,* ♂ ad. Fort Sisseton, S. Dakota.
10, 11. *Putorius longicauda spadix,* ♀. Elk River, Minnesota.
12–14. *Putorius arizonensis,* ♂ ad. Boulder County, Colo.
15. *Putorius frenatus,* ♀ ad. Cofre de Perote, Vera Cruz, Mexico.
16. *Putorius tropicalis,* ♀ ad. Jico, Vera Cruz, Mexico.

No. 11. NORTH AMERICAN FAUNA. June, 1896.

SYNOPSIS OF THE WEASELS OF NORTH AMERICA.

By C. HART MERRIAM.

The present synopsis includes the one ferret and all of the weasels yet discovered in North America north of Panama. Of the true weasels (subgenus *Ictis*) no less than 22 species and subspecies are here recognized, 11 of which are described for the first time.

Until very recently the group has been in a state of chaos, but now, thanks to Outram Bangs's excellent paper entitled 'A review of the weasels of eastern North America,'[1] the obscurity that has so long surrounded our eastern species has been cleared away and the task of revising the whole group is rendered comparatively easy. Additional material is needed from certain parts of the West, particularly from southeastern Alaska and the middle and northern parts of the Great Basin, and much remains to be learned respecting the extent to which intergradation exists between allied forms having contiguous ranges.

Excepting the circumpolar type, represented in America by the weasel of the barren grounds (*Putorius arcticus* nob.), and in Eurasia by the closely related *P. erminea*, the weasels of North America fall naturally into two groups, characterized by important cranial differences, and having complementary geographic ranges. The first is a boreal group comprising five forms: *richardsoni*, *alascensis*, *cicognani*, *streatori*, and *rixosus*, the southernmost of which (*cicognani*) reaches only the northern United States. The other is an austral group comprising the *frenatus* and *longicauda* series and including *P. peninsulæ*, of Florida. Of this series only a single species (*P. arizonensis*) reaches the lowermost of the boreal zones, and this only in the mountains.

Between these two groups are two very interesting species, *noveboracensis* and *tropicalis*—the former inhabiting the eastern United States, the latter the tropical belt of Mexico. Mr. Bangs has already shown that the female of *P. noveboracensis* resembles *P. cicognani*, while the male resembles *P. longicauda*. The case of *P. tropicalis* is exactly parallel, the female resembling *cicognani*, while the male resembles *frenatus*.

---

[1] Proc. Biol. Soc. Washington, X, pp. 1–24, Feb. 25, 1896.

Among mammals the female is often less specialized than the male and consequently bears more resemblance to the ancestral stock, thus giving a clew to the line of descent when this can not be determined from the male alone. In the present instance the females of *noveboracensis* and *tropicalis* have small, smoothly rounded skulls without sagittal crests and with narrow audital bullæ and inflated squamosals, as in the *cicognani* series, while the males have large angular skulls with well-developed sagittal crests, relatively broad audital bullæ, and flat squamosals, as in the *longicauda-frenatus* series. The inference is that the austral *longicauda-frenatus* series was derived from the boreal *cicognani* stock, and that the differentiation took place in the South. *P. noveboracensis* occupies middle ground geographically, and may have become differentiated from *cicognani* under existing conditions in the area it now inhabits; but *P. tropicalis*, which inhabits tropical Mexico, must either have originated from the *cicognani* stock when the latter was driven southward by the cold of the Glacial epoch, or must have accomplished a very remarkable migration.

Turning now to the weasel of the tundras (*P. arcticus*), the female is also found to resemble the *cicognani* type, indicating—at least so far as the American species go—that the whole group (subgenus *Ictis*) has sprung from an ancestral type related to *P. cicognani*.

Probably *cicognani* itself is a strongly specialized type, although the specialization took place a long time ago and seems to have been in the direction of greater simplicity. The tendency has been toward a narrowing of the skull as a whole and the obliteration of its prominences and angles. The zygomata have been reduced and drawn in close to the sides of the cranium, and the brain case has been narrowed, elongated, and smoothly rounded off, as if to enable the head to pass through small openings. The body as a whole has undergone parallel modification, presenting the extreme degree of slenderness known among the mammalia. This type of weasel seems to have been developed for the express purpose of preying upon field mice or voles, its narrow skull and cylindrical body enabling it to enter and follow their runways and subterranean galleries. The extreme development of the type is presented in *P. rixosus* and *P. streatori*, whose exceedingly small size and almost serpentine form make it possible for them to traverse the burrows of even the smaller mice.

It is an interesting fact that the geographic range of the *cicognani* group is almost coincident with that of the field mice of the subgenus *Microtus*. Farther south, where these mice occur sparingly or not at all, the *cicognani* series of weasels is replaced by the larger and more powerful *longicauda-frenatus* series. Where the ranges of the two overlap, as on the northern plains, the large weasel (*P. longicauda*) preys chiefly on pocket gophers (*Thomomys* and *Geomys*) and ground squirrels (*Spermophilus franklini* and *S. 13-lineatus*), while the smaller species (*cicognani* and *rixosus*) prey chiefly on mice.

Similarly in the far North, where the frozen tundras are inhabited by lemmings as well as voles, two weasels are present: the tiny, narrow-skulled *rixosus*, which feeds mainly on mice, and the large, broad-skulled *arcticus*, which feeds chiefly on lemmings and rabbits.

It seems clear, therefore, that the different types of weasels have been developed by adaptation to particular kinds of food.

It is much to be regretted that specimens of the South American weasels are not available for study in connection with the North American species. The only one I have seen is *P. affinis* Gray, which ranges from Costa Rica to northern South America. While differing specifically from *frenatus* it clearly belongs to the same group.

Except in winter, weasels are usually so difficult to procure in anything like satisfactory series that but few are available from most of the localities represented in collections. As a rule, the number is too small to afford reliable average measurements; hence the averages here given are subject to correction.

The skull drawings in Pl. I and those in the text (except figs. 10, 11, 15, and 16) were made by Benjamin Mortimer. Those in Pls. II to V, inclusive, were drawn by Dr. James C. McConnell under the supervision of the author. About half of the skulls shown in the latter plates were used by Mr. Bangs in his paper already referred to.

Except where the contrary is distinctly stated, all the measurements in this paper were taken in the flesh by the collector. It is hardly necessary to add that all measurements are in millimeters.

Genus PUTORIUS Cuvier, 1817.

Key to subgenera (for American forms only):

Size large, about equaling the mink (*Lutreola*); facial bar black; legs and feet abruptly darker than upper parts .... subgenus *Putorius*.

Size medium or small, never more than half as large as the mink (*Lutreola*); facial bar white or absent; legs and feet concolor with or paler than upper parts .... subgenus *Ictis*.

Subgenus PUTORIUS Cuvier, 1817.

Putorius Cuvier: Règne Animal, I, 147–149, 1817.
Cynomyonax Coues: Fur-Bearing Animals, 99, 147–148, 1877.

PUTORIUS NIGRIPES Aud. & Bach. Black-footed Ferret.

(Pl. I, figs. 1, 1a, 1b.)

1851. *Putorius nigripes* Aud. & Bach.: Quadrupeds N. Am., Vol. II, pp. 297–299, pl. 93, 1851.
1877. Coues: Fur-Bearing Animals, 149–153, 1877.

Type locality.—Plains of the Platte River, in Nebraska.

Geographic range.—Great Plains, from western North Dakota and northern Montana to Texas; not known west of eastern base of Rocky Mountains.

Characters.—Size of the mink; ears rather large; color buffy, with a dark area in middle of back; fore and hind feet, end of tail, and band across face (including eyes) black.

Color.—Ground color pale yellowish or buffy above and below, clouded on top of head (and sometimes on neck also) by dark-tipped hairs; face crossed by a broad band of sooty black, which includes the eyes; feet, lower part of legs, terminal third of tail, and preputial region, sooty black; back, about midway between fore and hind legs, marked by a large patch of dark umber-brown, which fades insensibly into the buffy of surrounding parts; muzzle, lips, chin, a small spot over each eye, a narrow band behind black facial bar, and sides of head to and including ears, soiled white; anterior margin of ear near base clouded with dusky.

Cranial characters.—Skull large and massive, very broad between orbits, and deeply constricted behind postorbital processes,[1] which are strongly developed; zygomata strongly bowed outward; audital bullæ obliquely flattened on outer side; a prominent bead over lachrymal opening.

Compared with our American weasels, the skull of *Putorius nigripes* may be told at a glance by its great size, the basilar length in adult males averaging about 65 mm., and in females about 62 mm. Compared with *P. eversmanni* of southern Siberia, it may be distinguished by the greater postmolar production of the palate, and by other minor cranial characters. From the common polecat of Europe (*Putorius putorius*) it differs in several important characters, as may be seen by reference to Pl. I. In *P. putorius* the postorbital region is very broad, the postmolar part of the palate exceedingly long, and the anterior part of the audital bullæ very different.

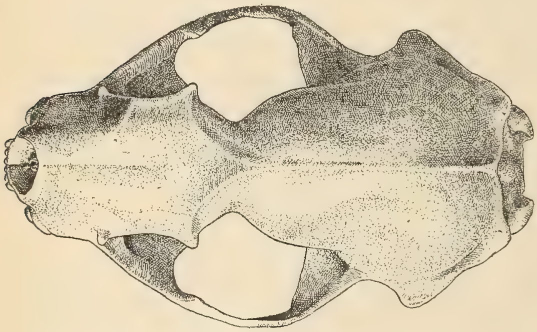


FIG. 1—*Putorius nigripes* ♂ ad. Trego County, Kans.

Remarks.—The black-footed ferret bears no resemblance whatever to any other American mammal, but is very closely related to the Siberian *Putorius eversmanni.* It differs from the latter in having much shorter and coarser fur, larger ears, and longer postmolar extension of the palate.

In some specimens of *Putorius nigripes* the pale buffy of the under parts is clouded across the breast between the fore legs, suggesting the dark breast of *P. eversmanni.* The dark facial mask encircles the eyes

---

[1] This constriction deepens with age, as in all the weasels. It is very deep in the skull shown in the accompanying text figure (fig. 1), which is that of an old individual; much less deep in the younger specimen shown on Pl. I, fig. 1.

(including the whitish supraorbital spot) and dips slightly forward before passing transversely across the face, so that its posterior border is in front of the plane of the outer angles of the eyes. Its anterior border sometimes extends forward almost to the nasal pad, but this is unusual. The black of the feet reaches up and covers the fore leg to the elbow, except along the outer side, and the hind leg to near the knee, except posteriorly.

Measurements.[1]—Average of 3 males: Total length, 570; tail vertebræ, 133; hind foot, 60. Average of 2 females: Total length, 500; tail vertebræ, 120; hind foot, 55.

Cranial measurements.—Average of 4 skulls of adult males: Basal length, 64; basilar length of Hensel, 62.5; zygomatic breadth, 43; mastoid breadth, 37; breadth across postorbital processes, 22.5; interorbital breadth, 18; breadth of constriction, 12.5; palatal length, 33; postpalatal length, 31.5. Average of 2 skulls of adult females: Basal length, 60.5; basilar length of Hensel, 58.5; zygomatic breadth, 39; mastoid breadth, 34.5; breadth across postorbital processes, 20; interorbital breadth, 16.5; breadth of constriction, 12; palatal length, 31; postpalatal length, 29.

Subgenus ICTIS Kaup, 1829.

Ictis Kaup: Entwickelungs-Geschichte und Naturliches System der Europäischen Thierwelt, pp. 40–41, 1829. (Contains only a single species, *Mustela vulgaris.*) Schulze: Faunæ Saxonicæ, Mammalia, p. 170, 1893.

Arctogale Kaup: Entwickelungs-Geschichte und Naturliches System der Europäischen Thierwelt, p. 30, 1829. (Contains two species, *erminea* and *boccamela.*)

Gale Wagner: Supplement Schreber's Säugthiere, II, p. 234, 1841. (Contains four species, *frenatus, erminea, boccamela,* and *vulgaris.*)

The names *Ictis* and *Arctogale* were proposed simultaneously in the same publication. Each is accompanied by a diagnosis and included species. The two names, therefore, according to Canon 18 of the A. O. U. Code of Nomenclature, are equally pertinent. In sequence of pagination *Arctogale* comes 10 pages ahead of *Ictis. Ictis* contains a single species (*vulgaris* = *nivalis* Linn.), while *Arctogale* has two (*erminea* and *boccamela*). The reasons for choosing *Ictis* instead of *Arctogale* are: (1) The type of *Ictis* is fixed beforehand, since it contained only a single species, while in *Arctogale* the type must be established arbitrarily; (2) *Arctogale* is now in current use for another genus of small carnivora;[2] to transfer it to a different group would lead to much confusion, and would be a great and seemingly unnecessary calamity. Hence, since there is no rule to the contrary, the better course seems to be to adopt *Ictis* and allow *Arctogale* to fall into synonymy.

---

[1] The number of specimens of which reliable flesh measurements are available is too small to afford satisfactory averages.

[2] *Arctogale* Peters, 1864, a genus of Viverridæ; Gray, Proc. Zool. Soc. London, 1864, pp. 508, 542–543; Blanford, Fauna British India, Mammalia, p. 114, 1888; Flower and Lydekker, Introduction to Study of Mammals, p. 533, 1891; Lydekker, Royal Nat. Hist., I, p. 461, 1893–94.

Furthermore, *Ictis* has been already revived by Schulze (Faunæ Saxonicæ, Mammalia, 170, 1893), though used by him in a much more comprehensive sense than that originally intended.[1]

List of North American Weasels with type localities.

No.	Name.	Type locality.
1	*Putorius cicognani*	Northeastern North America (north of lat. 41°)
2	*cicognani richardsoni*	Fort Franklin, Great Bear Lake.
3	*richardsoni alascensis*	Juneau, Alaska.
4	*streatori*	Skagit Valley, Washington.
5	*rixosus*	Osler, Saskatchewan.
6	*arcticus*	Point Barrow, Alaska.
7	*arcticus kadiacensis*	Kadiak Island, Alaska.
8	*noveboracensis*	State of New York.
9	*washingtoni*	Trout Lake, Mount Adams, Washington.
10	*peninsulæ*	Tarpon Springs, Florida.
11	*longicauda*	Carlton House, Saskatchewan.
12	*longicauda spadix*	Fort Snelling, Minn.
13	*saturatus*	Siskiyou Mountains, Oregon.
14	*arizonensis*	Flagstaff, Arizona.
15	*alleni*	Black Hills, South Dakota.
16	*xanthogenys*	Southern California.
17	*xanthogenys oregonensis*	Rogue River Valley, Oregon.
18	*frenatus*	Valley of Mexico.
19	*frenatus goldmani*	Pinabete, Chiapas, Mexico.
20	*frenatus leucoparia*	Patzcuaro, Michoacan, Mexico.
21	*tropicalis*	Jico, Vera Cruz, Mexico.
22	*affinis*	Colombia, South America.

PUTORIUS CICOGNANI Bonap. Bonaparte's Weasel.

(Pl. II, figs. 3, 3*a*, 4, 4*a*.)

1829. *Mustela* (*Putorius*) *vulgaris* Richardson: Fauna Boreali-Americana, Mammalia, pp. 45–46, 1829.
1838. *Mustela cicognanii* Bonaparte: Iconografia Fauna Italica, I, fasc. XXII, p. 4, 1838; Charlesworth's Mag. Nat. Hist., II, p. 37, Jan., 1838.
1839. *Putorius cicognanii* Richardson: Zoology Beechey's Voyage, p. 10*, 1839.
1857. Baird: Mammals North America, pp. 161–163, 1857.
1891. Mearns: Bull. Am. Mus. Nat. Hist., N. Y., III, p. 235, May, 1891.
1896. *Putorius richardsoni cicognani* Bangs: Proc. Biol. Soc. Wash., X, pp. 18–21, Feb. 25, 1896.
1877. *Putorius vulgaris* Coues: Fur-Bearing Animals, pp. 102–109, 1877. Merriam: Mammals Adirondacks, pp. 54–56, 1882 (habits); and most recent authors.

Type locality.—Northeastern North America.

Geographic distribution.—Boreal forest covered parts of North America from New England and Labrador to coast of southeastern Alaska (Juneau, Wrangel, and Loring), and south in the Rocky Mountains to Colorado (Silverton). It occurs in the interior of British Columbia (at Sicamous), but in the Puget Sound region is replaced by a smaller and darker form, *P. streatori*. In the United States it is common in New England and New York, and in the forest-covered parts of Minnesota. It probably occurs also in northern Michigan and Wisconsin.

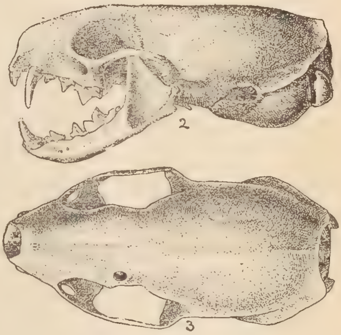
---

[1] Schulze included in *Ictis* the two European weasels, *vulgaris* and *erminea*, and also the mink, *lutreola*, and polecat, *putoria*.

General characters.—Size small; tail slender and rather short; color of under parts covering toes and inner sides of both fore and hind feet; color of upper parts never encroaching on belly, but ending along a straight line.

Color.—Upper parts in *summer pelage:* uniform dark brown, hardly darker on head; end of tail blackish; no dark spot behind corners of mouth; under parts, usually including upper lip, white, more or less tinged with yellow. In *winter pelage:* pure white with a strong yellowish tinge on rump, tail, and under parts; end of tail black.

Cranial characters.—Skull small, light, narrow, and elongated without marked postorbital processes, and only a slight postorbital constriction; zygomata narrow, and not bowed outward; brain case elongate and subcylindric; audital bullæ small, narrow, and subcylindric, almost continuous anteriorly (except in old age) with the greatly inflated squamosals; palate narrow; the tooth rows more nearly parallel than in the other species; skull of female similar to that of male, but smaller. Contrasted with *richardsoni*, the skull of *cicognani* is smaller, the audital bullæ decidedly smaller, and the dentition lighter. In nearly every series of *cicognani* there are one or two old males whose skulls are abnormally large and closely resemble skulls of *richardsoni*, except that the audital bullæ are always smaller.



FIGS. 2 and 3.—*P. cicognani* ♂ ad. Elk River, Minnesota.

Measurements.—Average of 5 males from Ossipee, N. H.: Total length, 278; tail vertebræ, 80; hind foot, 36.5. Average of 3 females: Total length, 230; tail vertebræ, 69; hind foot, 30.5.

PUTORIUS CICOGNANI RICHARDSONI (Bonap.). Richardson's Weasel.

1829. *Mustela* (*Putorius*) *erminea* Richardson: Fauna Boreali-Americana, pp. 46–47, 1829. (In part: specimen from Fort Franklin, Great Bear Lake. Not *M. erminea* Linn.)

1838. *Mustela richardsoni* Bonap.: Charlesworth's Mag. Nat. Hist., Vol. XI, p. 38, 1838. (based on Richardson's specimen from Great Bear Lake).

1839. *Putorius richardsoni* Rich.: Zool. Beechey's Voyage of Blossom, Mammalia, 10*, 1839.

1896. Bangs: Proc. Biol. Soc. Washn., X, pp. 1–24, Feb. 25, 1896. (In part.)

Type locality.—Fort Franklin, Great Bear Lake.

Geographic distribution.—Hudsonian timber belt from Hudson Bay to interior of Alaska and British Columbia.

General characters.—Similar to *P. cicognani* but larger; tail of medium length, its terminal third black.

Color.—Upper parts dull chocolate brown, this color reaching down on both fore and hind feet to base of toes; underparts whitish, more or less suffused with yellowish, the pale color extending out in a very narrow and sometimes interrupted strip along inner side of hind feet to toes; tail concolor all around except at tip, which is black for about one-third the total length of tail. In *winter pelage:* white all over except terminal third of tail, which is black; rump and belly more or less tinged with yellowish.

Cranial characters.—Skull long, narrow, and subcylindric like that of *cicognani*, from which it differs chiefly in larger size, larger audital bullæ, and heavier dentition.

Remarks.—*P. richardsoni*, as pointed out by Mr. Bangs, is simply a more northern form of *cicognani*, with which it intergrades completely. It inhabits the Hudsonian timber zone while *cicognani* inhabits the Canadian. On the north, where the timber ends and the tundra begins, the range of *richardsoni* meets that of *arcticus.* The two species differ widely in both cranial and external characters. The light subcylindric skulls of *richardsoni*, with the narrow frontals and appressed zygomata, require no comparison with the broad massive skulls of *arcticus* with their broadly flattened frontals and widely spreading zygomata. The external differences are almost as marked. In *richardsoni* the underparts are nearly white or, at most, only tinged with pale yellowish; the color of the upper parts covers both fore and hind feet, reaching the base of the toes; the tail is relatively long, concolor except at the tip, which is black for about one-third its length. In *arcticus* the under parts are deep yellow; the color of the upper parts stops short of the fore feet and reaches only halfway down the hind feet; the tail is short, yellow below on its basal half, and has a long, black pencil covering at least half its entire length.[1]

Measurements.—(From dry skin of male from Fort Simpson): Total length, 390; tail vertebræ, 95; hind foot, 43 (probably 45).

PUTORIUS RICHARDSONI ALASCENSIS subsp. nov. Juneau Weasel.

(Pl. II, figs. 2, 2*a*.)

Type from Juneau, Alaska. No. 74423, ♂ ad., U. S. National Museum, Dept. Agric. coll. Collected August 22, 1895, by Clark P. Streator. Original number 4806.

General characters.—Similar in size and general appearance to *P. richardsoni*, but white tips of fore and hind feet more extensive and interorbital region very much broader.

Color.—Upper parts dull chocolate brown, this color reaching down on fore legs to wrists and on hind legs to middle of upper side of feet;

---

[1] It is not strange that Mr. Bangs failed to discriminate between *arcticus* and *richardsoni*. The available material is scanty and mostly of poor quality, and most of the skins had the skulls inside. Through the kindness of Mr. F. W. True, curator of mammals in the United States National Museum, the skulls have been removed and placed at my disposal.

terminal third of tail black; under parts, including upper lip, fore feet, and distal half of hind feet, soiled white, tinged with yellowish. Winter pelage probably white.

Cranial characters.—Skull similar to that of *P. richardsoni*, but very much broader between orbits and across muzzle; postorbital processes more strongly developed; constriction deeper.

Remarks.—Mr. Streator obtained two males of this new weasel at Juneau in the latter part of August. He obtained also, at the same place and time, three females, which in color and markings agree with the males, but are hardly half as large. Their skulls are as small as those of true *cicognani*, which they closely resemble. If they are the females of *alascensis*, as seems probable, then this weasel exhibits as great sexual difference in size as *P. noveboracensis*, in which respect it stands unique as a member of the *cicognani* group. The only alternate possibility is that *cicognani* and *alascensis* occur together at Juneau, and that of the 5 specimens collected there by Streator the 2 males are *alascensis* and the 3 females *cicognani*.

Measurements.—Average of two males from Juneau, Alaska: Total length, 335; tail vertebræ, 95; hind foot, 48. Average of three females from same place: Total length, 270; tail vertebræ, 77; hind foot, 34.

PUTORIUS STREATORI sp. nov. Puget Sound Weasel.

(Pl. II, figs. 5, 5*a*, 6, 6*a*.)

Type from Mount Vernon, Skagit Valley, Washington. No. 76646, ♂ ad., U. S. Nat. Mus., Dept. Agric. coll. Coll. Feb. 29, 1896, by D. R. Luckey. (Original number 3)

Geographic distribution.—Puget Sound and coast region of Washington and Oregon; south at least to Yaquina Bay (Newport), Oregon. Confined to a narrow strip along the coast.

General characters.—Similar to *Putorius cicognani*, but smaller and darker, with color of upper parts encroaching on belly.

Color.—Upper parts, including upper lip and fore and hind feet, uniform dark chocolate brown, darkest on head, and encroaching far on belly and throat (often meeting along middle of belly); terminal third of tail black; under parts narrowly and irregularly white, faintly tinged with yellowish. *In winter pelage* at low altitudes the color of the upper parts is paler (almost drab brown) and the toes may become white; at higher altitudes the whole animal changes to white,[1] except the end of the tail, which always remains black.

Cranial characters.—Skull of male similar to that of male *cicognani*, but smaller, slightly broader interorbitally, and with somewhat more prominent postorbital processes and smaller audital bullæ. Skull of female very much smaller and more delicate than that of male, resembling female of *cicognani*, but smaller.

---

[1] Mr. R. E. Darrell, of Port Moody, British Columbia, writes me: "I have discovered that, although the weasels do not change color down near salt water, they do change to the white winter coat in the mountains." Specimens in the Department collection from Mount Adams, Washington, killed in February and March, are in the white winter pelage. The type and a female from the same locality (Mount Vernon, Skagit Valley) are in the drab-brown winter pelage.

Remarks.—Putorius streatori is a dark Pacific Coast form of *cicognani*, with which it may be found to intergrade. It differs conspicuously from *cicognani* in the color of the under parts, the dark chocolate brown of the back and sides encroaching far on the throat and usually meeting along the median line of the belly, thus reducing the white to a narrow and irregular strip, which expands on the anterior part of the throat, on the breast behind the fore legs, and immediately in front of the hind legs, and stops abruptly on the under surface of the thighs.

Five winter specimens from Sumas, British Columbia, kindly loaned by Mr. Outram Bangs, point toward intergradation with *cicognani*. In three out of the five, the toes of both fore and hind feet are white, and the color of the upper parts is much paler than in summer pelage. Two of these specimens have the bellies broadly white, as in *cicognani*. They are also much larger than *streatori*. Specimens from Sicamous, in the interior of British Columbia, are fairly typical *cicognani*, having the under parts broadly white; the upper lip, a strip along the inner border of the hind feet, and the toes of both fore and hind feet, white. Specimens from southeastern Alaska (Juneau, Wrangel, and Loring) must also be referred to *cicognani*, and not *streatori*.

Measurements.—Unfortunately, no flesh measurements are available from the type locality. Specimens from Trout Lake, near Mount Adams, Washington, are slightly smaller than the Mount Vernon specimens, and measure as follows: Average of two adult males: Total length, 270; tail vertebræ, 83; hind foot, 33. An adult female: Total length, 210; tail vertebræ, 51; hind foot, 24.

PUTORIUS RIXOSUS Bangs. Bang's Weasel.

(Pl. II, figs. 7, 7a.)

1857. *Putorius pusillus* Baird: Mammals N. Am., pp. 159–161, 1857. (In part: specimen from Pembina.)

1896. *Putorius rixosus* Bangs: Proc. Biol. Soc. Wash., Vol. X, pp. 21–22, Feb., 1896.

Type locality.—Osler, Saskatchewan, Canada.

Geographic distribution.—Boreal America from Hudson Bay to coast of Alaska (St. Michaels); south to northern Minnesota (Pembina) and Montana (Sun River).

General characters.—Smallest weasel known; tail short and without black tip; only American weasel lacking the black tip.

Color.—Summer pelage: Upper parts dark reddish brown; tip of tail not darker; under parts white. In *winter pelage:* Pure white all over, including end of tail.

Cranial characters.—Skull (of type specimen, ♀ ad., No. 642 Bangs' Coll.[1]) very much smaller than the smallest female of any other known species (total length from occiput to front of premaxillæ, 28.5; basal length, 26.5; zygomatic breadth, 14; length of palate, 11; interorbital breadth, 5.5; breadth across postorbital processes, 7.5; length of audital bullæ, 9.5). The skull is a miniature of *P. cicognani* except that the postorbital processes are more prominent, the brain case more compressed, and there is a distinct sagittal ridge.

---

[1] I am indebted to Mr. Bangs for the privilege of examining this specimen. Unfortunately, the basioccipital is broken off; hence the basilar length is estimated.

Measurements.—Type specimen, female, measured in flesh: Total length, 150; tail vertebræ, 31; hind foot in dry skins, 20–22.

PUTORIUS ARCTICUS sp. nov. Tundra Weasel.

(Pl. II, figs. 1, 1*a*; Pl. V, figs. 6, 6*a*.)

Type from Point Barrow, Alaska. No $\frac{14062}{23010}$ ♂ ad. U. S. Nat. Mus. Collected July 16, 1883, by John Murdoch. Original number, 1672.

Geographic distribution.—Arctic coast and tundras. Specimens examined from Anderson River, Franklin Bay, old Fort Good Hope, lower Mackenzie River, Point Barrow, and St. Michaels.

General characters.—Size large; ears small; tail short but with very long black pencil; underparts yellow (including underside of basal half of tail).

Color—(Type specimen, male adult.) Upper parts, including upper lip, dark yellowish brown; chin white; under parts deep ochraceous yellow, broadly including inner and posterior sides of fore legs, whole of fore feet, distal half and inner side of hind feet, and under side of tail to or nearly to black tip; black tip very long, covering at least half of tail (including long terminal hairs); color of upper parts not encroaching on belly. In *winter pelage*, white all over except long black tip of tail; the white tinged with yellow posteriorly.

Cranial characters.—Skull rather large, broad, and massive; frontal very broad interorbitally; muzzle broad and blunt; postorbital processes moderately developed; postorbital constriction marked; zygomata strongly bowed outward; brain case subtriangular and rather short; audital bullæ subcylindric; postglenoid space smaller than in *richardsoni* and hardly inflated except in female. Contrasted with *P. richardsoni*, the skull of *P. arcticus* is somewhat larger, much broader, and more massive; brain case subtriangular instead of subcylindric; zygomata bowed far outward instead of appressed; postorbital processes more prominent; postorbital constriction much deeper; frontal much broader interorbitally; palate broader posteriorly; dentition heavier. Adult male skulls of *P. arcticus* resemble certain old males of *washingtoni*, but differ in much greater breadth of frontal between orbits, broader muzzle, and blunter postorbital processes. *P. arcticus* resembles true *erminea* of Sweden much more closely than it does any American species.

Remarks.—*Putorius arcticus*, which has been heretofore confounded with *erminea* or *richardsoni*, is one of the most strongly characterized species of the genus. It is a large animal with deep ochraceous yellow under parts and a rather short tail which ends in a remarkably long black pencil. The skull differs from all other American weasels in the great breadth of the frontal region and the breadth and bluntness of the muzzle, in both of which respects it resembles true *erminea*. The only American species whose skull approaches it at all is *P. washingtoni*, as mentioned above. In external characters the differences are too great to require comparison.

It is interesting to find in this country an Arctic circumpolar weasel which, though specifically distinct, is strictly the American representative of the Old World *erminea*. The pattern of coloration, as described above (under *color*), is precisely as in *erminea*, but the tints differ materially. The upper parts in *erminea* lack the golden brown of *arcticus*, and the under parts are very much paler and of a different tint, being pale sulphur yellow instead of ochraceous. Moreover, *arcticus* lacks the whitish border to the ear which is present in *erminea*. In winter pelage the two seem to be indistinguishable except by cranial characters.

A small form of *arcticus* occurs on Kadiak Island, Alaska. It has smaller and narrower audital bullæ, less spreading zygomata, less divergent tooth rows, and decidedly shorter postmolar production of palate. It is probably worthy of recognition as subspecies *kadiacensis*. An adult male (No. 65290) collected April 25, 1894, by B. J. Bretherton, measured in the flesh: Total length, 318; tail vertebræ, 86; hind foot, 44. It is in the white winter pelage, just beginning to change, and the terminal half of the tail is black.

Measurements.—From dry skin of type, male adult, Point Barrow, Alaska: Total length, 380; tail vertebræ, 75; pencil, 55; hind foot, 48 (at least 50 in the flesh).

PUTORIUS NOVEBORACENSIS De Kay. New York Weasel.

(Pl. IV, figs. 1, 1a, 2, 2a; Pl. V, figs. 3, 3a.

1840. *Putorius noveboracensis* De Kay: Catal. Mammalia New York, p. 18, 1840 (*nomen nudum*); Zoology of New York, Mammalia, p. 36, 1842.
1840. Emmons: Rept. Quadrupeds Massachusetts, p. 45, 1840.
1857. Baird: Mammals N. Am., pp. 166–169, 1857.
1896. Bangs: Proc. Biol. Soc. Wash., X, pp. 13–16, Feb. 25, 1896.
1877. *Putorius* (*Gale*) *erminea* Coues: Fur-Bearing Animals, pp. 109–136 (in part), 1877.
Putorius erminea Thompson, Aud. & Bach. (part), Allen, Merriam, and most recent authors.

Type locality.—New York State.

Geographic distribution.—Eastern United States from southern Maine to North Carolina, and west to Illinois.

General characters.—Male large; female small; tail long and bushy, much longer than in *cicognani*, but shorter than in *longicauda;* the black terminal part longer than in any other species except *articus*, covering one-third to one-half the tail and measuring 50 to 75 mm. Animal turns white in winter in northern part of range. Extraordinary sexual difference in size and cranial characters.

Color.—Summer pelage: Upper parts, including fore and hind feet and anal region, and often encroaching irregularly on belly, rich dark chocolate brown, sometimes suggesting seal brown; under parts (usually including upper lip) white, more or less washed with yellowish; no yellow on under side of tail or on hind feet, the color of under parts stopping short of ankle. *Winter pelage:* In southern part of range similar to summer pelage, but upper parts paler, nearly drab brown. Northern specimens white all over except terminal third of tail, which is jet black; throat, belly, posterior half of back and tail always suffused with yellowish.

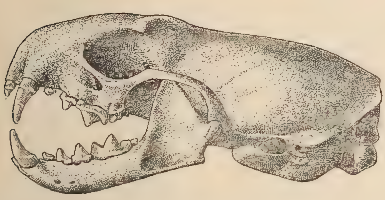
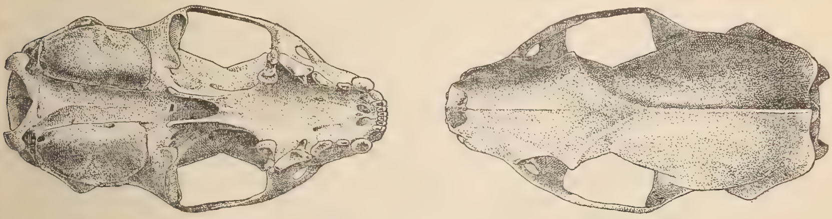


FIG. 4.—*Putorius noveboracensis* ♂ ad. Adirondacks, New York.

Cranial characters.—Skull of male large, heavy, and elongate; sagittal ridge present in adults; postorbital processes and constriction moderately developed; zygomata *not bowed outward;* audital bullæ rather narrowly oval, usually rounded anteriorly as well as posteriorly. Skull of female very small, light, and narrow, with brain case elongate and subcylindric, much as in *cicognani;* audital bullæ small, narrow, and not rising abruptly anteriorly from inflated squamosals, which latter are elongated and strongly inflated as in *cicognani.* Skulls of males may be distinguished from those of male *longicauda* by shorter postorbital processes, less marked postorbital constriction, less triangular brain case, lower sagittal ridge, very much narrower zygomata, which *are not bowed outward,* narrower palate, and narrower audital bullæ, which are more rounded anteriorly. The resemblance to *P. washingtoni* is very much closer, but male skulls of *noveboracensis* may be distinguished by larger size and much larger audital bullæ. The female skull, owing to the inflation of its squamosals inferiorly, needs no comparison with either *washingtoni* or *longicauda,* but is with difficulty separated from *cicognani* in regions where the two species overlap. The postorbital processes are longer and the carnassial and sectorial teeth larger in the females of *noveboracensis* than in *cicognani* from the same localities.



FIGS. 5 and 6.—*Putorius noveboracensis.* Adirondacks, New York.

Remarks.—Putorius noveboracensis may usually be distinguished from *P. cicognani* by larger size and also by the longer and more bushy tail, and greater length of the black terminal part. Females of *noveboracensis*, however, sometimes resemble males of *cicognani* rather closely. They may be distinguished not only by the greater length of the tail but also, if in summer pelage, by the absence of yellow from the under side of the tail and inner sides of the hind feet, which parts in *cicognani* usually show more or less yellow.

Measurements.—Average of 10 males: Total length, 407; tail vertebræ, 140; hind foot, 47. Average of 10 females: Total length, 324; tail vertebræ, 108; hind foot, 34.5.

PUTORIUS WASHINGTONI sp. nov. Washington Weasel.

(Pl. IV, figs. 3, 3a, 4, 4a.)

Type from Trout Lake, base of Mount Adams, State of Washington. No. 76322, ♂ ad., U. S. Nat. Mus., Dept. Agriculture collection. Collected December 15, 1895, by D. N. Kaegi.

General characters.—Similar to *P. noveboracensis* in size and general appearance, but with longer tail and shorter black tip. Female very much smaller than male, as in *noveboracensis*.

Color.—Color in summer pelage unknown (probably dark chocolate brown). There are two winter pelages, probably dependent on altitude. In *drab* winter pelage: Upper parts uniform drab brown; end of tail black; under parts white, more or less suffused with pale yellowish. The color of the upper parts encroaches on the sides of the belly as in *noveboracensis*, and a brown spot is present behind the corners of the mouth, which may or may not be confluent with the brown of the cheeks. In the type and two other specimens the hind legs and feet are the same color as the upper parts except that the toes are tipped with whitish and the tips of the fore feet are white. In another specimen, collected January 22, the white is more extensive, covering all of the fore feet and about half of the hind feet. In summer pelage the legs and feet are doubtless the same color as the upper parts, the white of the belly stopping high up on the thighs. In *white* winter pelage: White all over except black tip of tail; tail, rump, and belly strongly suffused with yellow. In one specimen (No. 76604, male, February 7, 1896) the yellow reaches forward over the back nearly to the shoulders; in another (No. 76588, male, February 4, 1896) the whole back is white.

Cranial characters.—The skulls of the two sexes differ greatly: that of the male resembles *noveboracensis* closely in size and general characters, but differs in having the audital bullæ much shorter and the postorbital processes less strongly developed. The postorbital constriction is equally marked. The skull of the female is very much smaller than that of the male, averaging about 38 mm. in length, while the male averages 45 mm. Contrasted with the female of *noveboracensis* the brain case is broader posteriorly and less cylindric. The audital bullæ are more sharply separated from the squamosal inflation and the latter is only slightly marked, not reaching the plane of the bullæ. The resemblance therefore to *P. cicognani* is much less marked in the female *washingtoni* than in the female *noveboracensis.*

Remarks.—This new species is represented in the collection by 14 skulls and 6 skins, of which the greater number are males. The female is darker than the males, and the top of the head is darker anteriorly than the rest of the upper parts, while in the males it is concolor with the back. These differences are probably seasonal, the female not having completed the change from summer to winter pelage, though collected December 11. All are from the Mount Adams region.

Measurements.—The skins, which are well made, afford the following approximate measurements: Male, total length, 240; tail vertebræ, 155; hind foot, 44. Female, total length, 360; tail vertebræ, 120; hind foot, 37.

PUTORIUS PENINSULÆ Rhoads. Florida Weasel.

(Pl . IV, figs. 5, 5a; Pl. V, fig. 5.)

Putorius peninsulæ Rhoads: Proc. Acad. Nat. Sci. Phila., June 1894, 152–155. Bangs: Proc. Biol. Soc. Wash., X, pp. 10–13, Feb. 25, 1896.

Type locality.—'Hudsons,' 14 miles north of Tarpon Springs, Fla.

Geographic distribution.—Peninsula of Florida; limits of range unknown.

General characters.—Size rather large, about equaling male of *Putorius noveboracensis;* skull similar to that of *longicauda*, but with very large audital bullæ.

Color.—Upper parts dull chocolate brown, darkest on head; upper lip and chin whitish; rest of under parts, including fore feet and toes of hind feet, yellowish; a brown spot behind corners of mouth; a small tuft of white hairs under anterior root of ear. The color of the under parts covers the belly broadly and is not encroached upon by the color of the upper parts. Irregular and inconstant white markings are sometimes present between and behind the eyes.

Cranial characters.—Skull rather massive, resembling that of *longicauda,* but with higher sagittal crest; less spreading zygomata; narrower, higher, and more swollen audital bullæ, and less prominent postorbital processes. Contrasted with *P. noveboracensis* the postorbital constriction is deeper, the brain case higher and more subtriangular, the audital bullæ higher and more swollen, the upper carnassial tooth decidedly larger, and the molar smaller. The upper molar is peculiar: It is short, hardly expanded at either end, and implanted at right angles to the premolar series.

Measurements.—An adult female from Tarpon Springs, Fla.: Total length, 374; tail vertebræ, 127; hind foot, 44.5.

PUTORIUS LONGICAUDA Bonaparte. Long-tailed Weasel.

(Pl. III, figs. 3, 3a, 4, 4a; Pl. V, figs. 1, 1a.)

1829. *Mustela (Putorius) erminea* Richardson: Fauna Boreali-Americana, pp. 46–47, 1829 (in part: Specimen from Carlton House).

1838. *Mustela longicauda* Bonaparte: Charlesworth's Magazine Nat. Hist. N. S., II, p. 37–38, 1838 (based on Richardson's long-tailed variety of *erminea* from Carlton House).

1839. *Putorius longicauda* Rich.: Zool. Beechey's Voyage of Blossom, p. 10,* 1839.
1857. Baird: Mammals N. Am., pp. 169–171, 1857.
1877. Coues: Fur-Bearing Animals, pp. 136–142, 1877.
1896. Bangs: Proc. Biol. Soc. Wash., X, pp. 7–8, Feb. 25, 1896.

Type locality.—Carlton House, on North Saskatchewan River, Canada.

Geographic distribution.—Great Plains from Kansas northward.

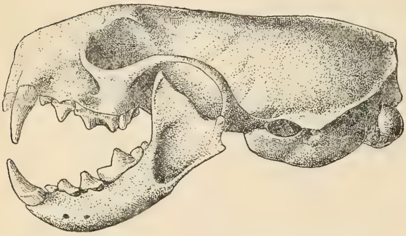
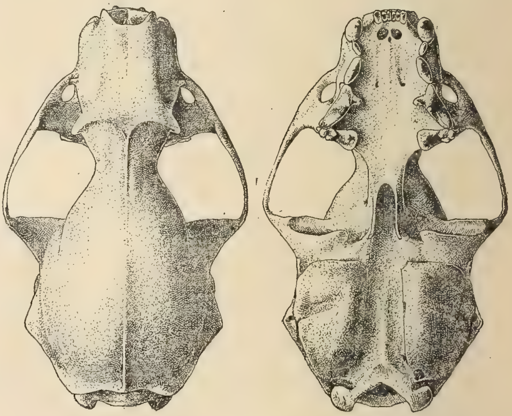


FIG. 7.—*Putorius longicauda.* Fort Sisseton, S. Dak.

General characters.—Size large (adult males averaging about 450 mm. in total length); tail very long (vertebræ 155 mm. or more in males), its black tip rather short; under parts always strongly yellowish or ochraceous.

Color.—Upper parts pale yellowish brown, or pale raw-umber brown, becoming darker on head; terminal part of tail black; chin and upper lip all the way round white; rest of under parts varying from strong buffy yellow to ochraceous orange, the color extending from throat posteriorly, including upper side of fore feet, inner side of hind feet, and upper side of hind toes; under side of tail more or less suffused with yellowish; soles of hind feet brownish. In worn summer pelage the color of upper parts is decidedly paler, and in some old specimens the upper and lower surfaces are not sharply differentiated. The orange tinge of the under parts is strongest on the throat.



FIGS. 8 and 9.—*P. longicauda* ♂ ad. Fort Sisseton, S. Dak.

Cranial characters.—Skull large, broad, and massive, with well-developed postorbital processes, strongly marked postorbital constriction, and a moderate sagittal crest; zygomata bowed strongly outward; brain case subtriangular as seen from above; audital bullæ rather broad and subrectangular; palate broad; dentition heavy; audital bullæ anteriorly rising abruptly from squamosal, which is not inflated in either sex; skull of female similar to male, but smaller, and with only a slight sagittal ridge. Contrasted with male skulls of *noveboracensis* and *washingtoni*, the male of *longicauda* is broader and relatively shorter, with more spreading zygomatic arches, longer postorbital processes, deeper postorbital constriction, and much broader and more rectangular audital bullæ, which as a rule are broadly truncate instead of narrowly rounded anteriorly.

Measurements.—Average of 4 males from plains of Saskatchewan and Alberta: Total length, 450; tail vertebræ, 165; hind foot, 51. Average of 3 females: Total length, 387; tail vertebræ, 144; hind foot, 44.

PUTORIUS LONGICAUDA SPADIX Bangs.

Putorius longicauda spadix Bangs: Proc. Biol. Soc. Wash., X, pp. 8–9, Feb. 25, 1896.

Type locality.—Fort Snelling, near Minneapolis, Minn.

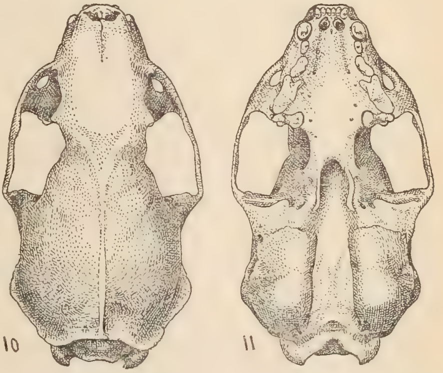
Geographic distribution.—Edge of timber belt in Minnesota, along boundary between Transition and Boreal zones.

General characters.—Similar to *P. longicauda*, but much darker.

Color.—*Summer pelage:* Upper parts chocolate brown, darkest on the head, but paler than in *noveboracensis;* chin and upper lip whitish all round; rest of under parts, including upper surfaces of fore feet and toes of hind feet, buffy yellow; terminal part of tail black. *Winter pelage:* Snow-white everywhere except black tip of tail and a yellowish suffusion on rest of tail, and sometimes also on under side of hind feet.

Cranial characters.—As in *P. longicauda.*

Measurements.[1]—Average of 6 males from Fort Snelling, Minn.: Total length, 460; tail vertebræ, 166.5; hind foot, 54.5. Average of 3 females: Total length, 356; tail vertebræ, 132; hind foot, 43.5.



FIGS. 10 and 11.—*Putorius l. spadix* ♀ ad. Elk River, Minnesota.

PUTORIUS SATURATUS sp. nov. Cascade Mountain Weasel.

Type from Siskiyou, near southern boundary of Oregon (altitude, about 4,000 feet). No. 65930, ♂ ad., U. S. Nat. Mus., Department of Agriculture collection. Collected June 6, 1894, by Clark P. Streator. Orig. No. 3905.

General characters.—Similar to *P. arizonensis*, but larger and darker, with belly more ochraceous, and with distinct spots behind the corners of the mouth.

Color.—Color of upper parts in summer pelage (June) dark raw umber brown, becoming much darker on the top of the head and nose; terminal part of tail black; a brown spot at corner of mouth which may be confluent with brown of cheeks; color of upper parts extending over outer side of forearm to wrist, and over hind foot to toes; chin white; rest of under parts ochraceous or orange yellow, including the fore feet, and reaching narrowly down the under side of hind leg to ankle, whence it may or may not extend in a narrow line along inner side of foot to toes; under side of tail more or less suffused with golden chestnut; anal region chestnut brown; in worn pelage the colors are everywhere much paler.

---

[1] These measurements were taken in the flesh by Dr. E. A. Mearns, to whom I am indebted for them.

Cranial characters.—Skull similar to that of *P. arizonensis* but with postorbital processes broader at base and less peg-like.

Remarks.—This handsome weasel replaces *longicauda* on the Cascade and Siskiyou mountains of Oregon and Washington, reaching a short distance into British Columbia. The only specimens examined have come from Siskiyou, Oregon, and Chilliwack, British Columbia (the latter, No. 3553, collection of E. A. and O. Bangs).

Measurements.—Average of 2 males from Siskiyou Mountains, Oregon: Total length, 423; tail vertebræ, 164; hind foot, 48.

PUTORIUS ARIZONENSIS Mearns. Mountain Weasel.

Putorius arizonensis Mearns: Bull. American Museum Nat. Hist., Vol. III, No. 2, pp. 234-235, May, 1891.

Putorius longicauda Merriam: Mammals of Idaho, N. Am. Fauna, No. 5, pp. 83-84, Aug. 1891 (from mountains of Idaho).

Type locality.—San Francisco forest, Arizona (a few miles south of Flagstaff).

Geographic distribution.—Broadly, the Sierra Nevada and Rocky Mountain systems, reaching British Columbia in the Rocky Mountain region, but not known north of the Siskiyou Mountains in the Sierra-Cascade system.

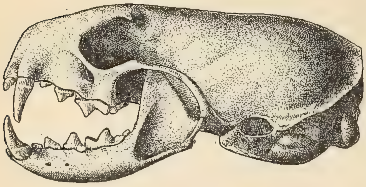


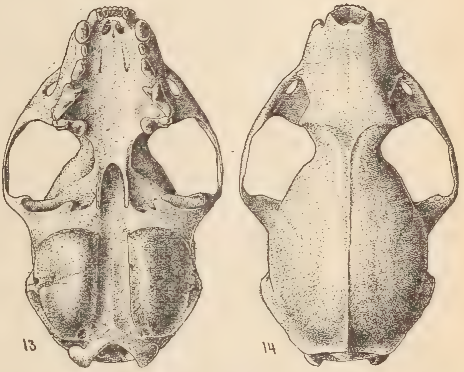
FIG. 12.—*P. arizonensis* ♂ ad. Boulder County, Colo.

General characters.—Similar to *Putorius longicauda* in color and markings, but much smaller in size.

Color.—Upper parts from occiput to black tip of tail, raw umber brown; head decidedly darker; end of tail black; chin and upper lip all round white; rest of under parts including upper surfaces of fore feet and inner half of hind feet and upper surfaces of hind toes ochraceous or ochraceous yellow, varying in tint.

Cranial characters.—Skull similar to that of *longicauda* but decidedly smaller and less triangular; narrower across mastoids and more bulging in parietals.

Remarks.—*Putorius arizonensis* is a mountain form of *longicauda*, which it closely resembles except in size. The type specimen, collected by Dr. Mearns on the pine plateau of Arizona a few miles south of Flagstaff, is an immature female and is of unusually small size. A male obtained by him near the same place is of the normal size, as is another male in the Department collection from Springerville, Ariz., collected by E. W. Nelson. Specimens from the northern Rocky Mountain region (St. Mary Lake, Montana, and Salmon River and Pahsimeroi Mountains, Idaho) differ in color from the typical animal from Arizona and Colorado, and agree with *alleni* from the Black Hills in having the upper parts strongly suffused with golden brown, the yellow of the under parts yellow rather than ochraceous, and the under side of the tail strongly yellow on the basal half or two-thirds. The skulls, however, lack the flattened audital bullæ of *alleni*. Specimens from the Sierra Nevada in California are hardly distinguishable from the Rocky Mountain animal. The only apparent external differences are that the yellow of the under parts reaches up farther under the chin, the white of the upper lip is less extensive, and the under side of the tail is more suffused with yellowish. But none of these characters is constant. In one specimen from Donner, Calif. (No. 2650, female, Merriam Coll.), even the white upper lip is as marked as in Rocky Mountain specimens; it reaches all the way round, fills the space under the nasal pad to the nostrils, and broadens strongly under the eyes. In cranial characters also the differences are slight and inconstant. The postorbital processes are longer and more slender, often becoming peg-like in old males. The audital bullæ average smaller and more convex anteriorly, and in the female are decidedly narrower and more subcylindric. But in an adult female from Fort Klamath, Oreg., the bullæ are nearly as broad as in Rocky Mountain females. The three female skulls I have seen of the Sierra form are decidedly smaller than females from the Rocky Mountains.



FIGS. 13 and 14.—*P. arizonensis* ♂ ad. Boulder County, Colo.

The Sierra specimens show a strong tendency to grade into, or at least toward *xanthogenys*. In nearly half the specimens examined white hairs are present between the eyes, and in several they are sufficiently numerous to form a conspicuous white spot, though the spot is not large and rectangular as in true *xanthogenys*. The white cheek spots I have not seen in Sierra specimens, but the brown spots behind the corners of the mouth are sometimes present (as in No. 30655, male, from Upper Cottonwood Meadows, near Mount Whitney, Calif.).

A specimen from St. George, Utah, an old female, differs in some respects from typical *arizonensis*. The skull is small and relatively short, and the shortening is mainly in the palate and rostral part, which measures 2 mm. less than the average of adult females of *arizonensis* of the same size. Moreover, the postorbital processes are longer and more slender than in any female of *arizonensis* I have examined from either the Rocky Mountain or Sierra systems. Externally the St. George specimen differs from typical *arizonensis* in the following particulars: Yellow of underparts more strongly tinged with ochraceous; white of upper lip narrow and not reaching around anteriorly; brown of upper parts reaching down on outer side of arm to wrist; a small brown spot bearing two bristles just behind each corner of mouth. In this respect, and this only, it resembles *xanthogenys;* there is no trace of white on the cheeks or between the eyes.

Measurements.—Average of 5 males from the Rocky Mountains: Total length, 385; tail vertebræ, 144; hind foot, 44.5. Average of 4 females: Total length, 358; tail vertebræ, 130; hind foot, 40.

PUTORIUS ALLENI sp. nov. Black Hills Weasel.

Type from Custer, Black Hills, South Dakota. No. $\frac{4485}{5120}$, ♂ ad., Merriam collection. Collected July 12, 1888, by Vernon Bailey. Original No. 90.

Geographic distribution.—Black Hills, South Dakota.

Characters.—Similar to *P. arizonensis* in size and general characters, but upper parts more suffused with yellowish and audital bullæ flatter.

Color.—Upper parts from occiput to black tip of tail golden or yellowish-brown, in some lights with an olivaceous tinge; head dark brown, without yellowish tinge; upper lip and chin white; rest of underparts, including inner sides of legs, whole of fore feet, toes of hind feet and under side of basal part of tail, intense buffy yellow.

Cranial characters.—Skull similar to that of *arizonensis*, but audital bullæ much flatter and somewhat smaller; brain case slightly flatter and bulging laterally immediately behind constriction; frontal somewhat broader interorbitally; skull as a whole shorter. The skull of an old female (No. 7441, Am. Mus. Nat. Hist.) is much smaller than the male, and the audital bullæ are narrow and not flattened. In both sexes the postorbital processes are strongly developed.

Remarks.—Putorius alleni is an isolated and only slightly differentiated form of *P. arizonensis*, from which it is completely cut off geographically. It is surrounded on all sides by the large weasel of the plains, *P. longicauda.* In worn summer pelage the color differences that distinguish it from *arizonensis* are not apparent.

I take pleasure in naming the species in honor of Dr. J. A. Allen, of the American Museum of Natural History, New York, who has recently published an important paper on the mammals of the Black Hills, and to whom I am indebted for the loan of three additional specimens.

Measurements (of type specimen, male adult).—Total length, 372; tail vertebræ, 137; hind foot, 44.

PUTORIUS XANTHOGENYS (Gray). California Weasel.

1843. *Mustela xanthogenys* Gray: Annals and Magazine Nat. Hist., XI, pp. 118, 1843.
1857. *Putorius xanthogenys* Baird: Mammals N. Am., pp. 176–177, 1857.
1877. *Putorius* (*Gale*) *brasiliensis frenatus* Coues: Fur-Bearing Animals, pp. 142–146, 1877 (in part).

Type locality.—Southern California, probably vicinity of San Diego.

Geographic distribution.—Sonoran and Transition faunas of California, on both sides of the Sierra Nevada.

General characters.—Size medium; tail long; face conspicuously marked with whitish, but rest of head not black; under parts ochraceous.

Color.—Upper parts from back of head to terminal part of tail in *summer pelage* raw-umber brown, tinged with golden; in *winter pelage*, drab brown, without yellowish suffusion; head always darker, becoming dusky over nose; a large rectangular spot between eyes, and a broad oblique band between eye and ear, whitish; end of tail black; a brown spot behind corners of mouth; chin white; rest of under parts, including fore feet all round and inner side and toes of hind feet, varying from buffy ochraceous to ochraceous orange. In some specimens the ochraceous covers the greater part of the hind feet as well as the toes.

Cranial characters.—Skull of the *longicauda* type and practically indistinguishable in size and characters from *P. arizonensis;* skull as a whole short and broad; zygomata bowed outward; postorbital processes strongly developed; sagittal ridge distinct; audital bullæ moderate, usually truncate anteriorly; skull of female similar to that of male, but smaller.

Remarks.—*Putorius xanthogenys* inhabits the San Joaquin and Owens valleys and the whole of southern California except the higher mountains. In ascending the mountains it gradually loses the facial markings and seems to grade into *P. arizonensis*, the weasel of the mountain summits.

Measurements.—Average of 7 males from southern California: Total length, 402; tail vertebræ, 156; hind foot, 43.5. Average of 3 females: Total length, 368; tail vertebræ, 135; hind foot, 40.5.

PUTORIUS XANTHOGENYS OREGONENSIS subsp. nov. Oregon Weasel.

Type from Grants Pass, Rogue River Valley, Oregon. No. $\frac{32019}{43828}$, ♀ ad., U. S. Nat. Mus., Dept. Agric. Coll. Collected December 19, 1891, by Clark P. Streator. Original number 1404.

Geographic distribution.—Rogue River Valley, Oregon; limits of range unknown.

General characters.—Similar to *P. xanthogenys* but decidedly larger, darker in color, and with face markings much restricted.

Color.—Upper parts in winter pelage pale chocolate brown, slightly darker on head; a small and ill-defined patch between eyes, and a narrow vertical bar between eye and ear, white; throat white; rest of under parts, including fore feet and inner sides and distal half of hind feet, pale yellowish; terminal one-fifth of tail black; rest of tail above and below concolor with back and without the yellowish tinge which is characteristic of *xanthogenys*.

Cranial characters.—Skull similar to that of *xanthogenys* but larger and decidedly broader. The skull of the type, an adult female, compared with skulls of *xanthogenys* of the same sex and age from southern California, differs in the following particulars: Skull everywhere broader; muzzle, palate, interorbital breadth and constriction very much broader; zygomata more spreading.

Measurements.—Type specimen, female adult: Total length, 412; tail vertebræ, 155; hind foot, 44.

PUTORIUS FRENATUS (Lichtenstein). Bridled Weasel.

(Pl. III, figs. 1, 1a, 1b, 2.)

1813. *Mustela brasiliensis* Sevastianoff: Mem. Acad. Imp. Sci. St. Petersburg, IV, 356–363, Table IV, 1813. (Name on plate only; diagnosis in text.) Preoccupied by *Mustela brasiliensis* [an otter] Gmelin, 1788.

1832. *Mustela frenata* Lichtenstein: Darstellung neuer oder wenig bekannter Säugethiere, Pl. XLII and corresponding text (unpaged), 1832.

1857. *Putorius frenatus* Baird: Mammals N. Am., 173–176, 1857.

Type locality.—Valley of Mexico, near City of Mexico.

General characters.—Size large; tail long; its black tip relatively short; head black, with conspicuous white markings.

Color.—Top of head blackish, interrupted between eye and ear by a broad, whitish band, which is nearly confluent with a patch of same color between the eyes; rest of upper parts brown; a dark spot behind corners of mouth; chin and throat whitish; rest of under parts ochraceous yellow; forefeet to or above wrists whitish or pale buffy yellowish, continuous with and shading into ochraceous of under parts; color of under parts extending down on inner side of hind legs and feet to toes, which are whitish or yellowish white.

Cranial characters.—Skull large and massive, with strongly developed postorbital processes, deep postorbital constriction, marked sagittal crest, and peculiar audital bullæ, which are obliquely truncated anteriorily (the inner side reaching farthest forward) and abruptly highest on inner side, falling away suddenly on outer side so as to form a rounded ridge along the inner side of the longitudinal axis of the bulla. The skull of *frenatus* resembles that of *longicauda*, but is considerably larger, and differs in the form of the audital bullæ just described, and also in the extent of the postglenoid space, which is much larger than in *longicauda*. The dentition is heavy and the upper carnassial tooth relatively shorter than in *longicauda*. The ramus of the under jaw is much more convex inferiorly.

Remarks.—Lichtenstein, in his original description of *Mustela frenata*, states that the tail is about one-third longer than that of the European weasel (*erminea*); that only its extreme tip is black; that the head, ears, and crown are black, this coloring fading into the reddish brown of the upper parts on the back of the head behind the ears; that the facial markings, throat, and breast are white; the remainder of the under parts ocher yellow. The white spot between the eyes is described as heartshaped, and in the colored plate it is shown to be nearly, but not quite, confluent with the white patch between the eye and ear. The colors in the plate are not good, as the whole under parts are white instead of ocher yellow, and the black tip of the tail is not shown. The specimen seems to have been in worn pelage. Lichtenstein had two specimens, both collected by Deppe near the City of Mexico.

Fortunately, the Department collection contains two specimens collected by E. W. Nelson at Tlalpam, in the Valley of Mexico, which may be considered topotypes of *frenatus*, for they not only came from the same locality as Lichtenstein's types, but also agree essentially in every detail with his excellent description. The only points in which the description fails to agree absolutely with the specimens is that in the latter the white of the throat is less pure and the black tip of the tail perhaps a trifle more extensive than one would infer from the description; but the throat is white in contrast with the strongly ochraceous yellow of the rest of the under parts, and a specimen in the United States National Museum from the City of Mexico (No. 1060, ♀ ad., J. Potts) has both throat and breast white, as in the original description.

The statement that only the extreme tip of the tail is black was made in comparison with the European weasel (*erminea*), in which nearly half of the tail is black. Hence the description agrees entirely with the specimens in hand. One point not mentioned in the description is shown in the plate, namely, that the hind feet and toes are in large part whitish or yellowish white. The quantity of white is variable. In a young male from Tlalpam (No. 50827) it is restricted to the inner side of the foot, hardly reaching the toes, while in an adult male from the same locality (No. 50826) it includes the toes. The whitish spot between the eyes is also variable, both in form and extent. Lichtenstein described it as heart-shaped, and his figure shows that it is narrow where it approaches closest to the stripe between the eye and ear, with which it is nearly, but not quite, confluent. This is precisely its condition in the adult male from Tlalpam, which may be considered a duplicate type of the species. In this specimen the median white spot is almost divided by the dark color of the forehead, which pushes down between the eyes, so that the whitish spot might be described as a narrow stripe over each eye, the two becoming confluent below. In the young specimen the white spot is subrectangular and not divided by the black of the forehead.

Note on Putorius brasiliensis.—In 1813 a Russian naturalist, Sevastianoff, gave the name '*Mustela brasiliensis*' to a weasel brought to St. Petersburg by Capt. A. J. Krusenstern on his return from a voyage around the world. The animal was said to have come from Brazil, but no definite locality was given. In the numerous publications that have since appeared relating to the mammals of Brazil and adjacent territory, no weasels are mentioned as inhabiting that country, and the species described from the mountains to the westward differ so widely from Sevastianoff's *brasiliensis* that it is almost certain his animal did not come from Brazil. The original description (including measurements) agrees in every respect with *P. frenatus* of Lichtenstien from the Valley of Mexico, indicating that the two animals are identical. On this assumption the well-known and appropriate name *frenatus* would have to fall before the earlier and inappropriate '*brasiliensis.*' Fortunately, however, Sevastianoff placed his animal in the genus *Mustela*, and the name *Mustela brasiliensis* is preoccupied by Gmelin for a South American otter. (Syst. Nat., ed. 13, p. 93, 1788.) Hence, unless some earlier name is found, *frenatus* will stand for the Mexican bridled weasel.

Measurements.—An adult male from Tlalpam, Valley of Mexico (type locality): Total length, 505; tail vertebræ, 203; hind foot, 53. Average of 6 males from Brownsville, Tex.: Total length, 488; tail vertebræ, 192; hind foot, 51. Average of 3 females from Brownsville: Total length, 438; tail vertebræ, 187; hind foot, 41.5.

PUTORIUS FRENATUS GOLDMANI subsp. nov.

Type from Pinabete, Chiapas, Mexico. No. 77519, ♂ ad., U. S. Nat. Mus., Dept. Agric. coll. Collected Feb. 10, 1896, by E. A. Goldman. Altitude about 8,200 feet (=2,500 meters). Original number 9279.

Geographic distribution.—Mountains of southeastern Chiapas; limits of range unknown.

General characters.—Similar to *P. frenatus* in size and general characters, but tail and hind feet longer; light markings more restricted; black of head reaching much farther back on neck; color of upper parts darker and more extensive, encroaching on sides of belly and covering fore and hind feet; black tip of tail longer.

Color.—Upper parts, including whole of fore and hind feet, dull, dark chestnut brown, washed with black on the neck from shoulders forward, and becoming pure black on the head; face marked by a whitish patch between the eyes, and a narrow, oblique band between eye and ear; a blackish spot behind angle of mouth; color of under parts salmon ochraceous, reaching wrists inferiorly, but not reaching heels; terminal third of tail black.

Cranial characters.—Skull rather large; zygomata moderately spreading; squamosal inflation moderate, but large for a member of the *frenatus* series; audital bullæ small, steep on inner side, and only slightly elevated anteriorly above squamosal inflation. The skull as a whole resembles that of *frenatus*, but differs conspicuously in the greater length and inflation of the postglenoid part of the squamosal, greater breadth of the basioccipital, and in the size and form of the audital bullæ. The latter are very narrow, low anteriorly where they meet the inflated squamosal without an abrupt step, and high along the inner side.

Remarks.—Mr. E. W. Nelson writes me that this fine weasel is found sparingly in the forest about Pinabete, Chiapas, at an altitude of 7,000 to 8,000 feet (2,100 to 2,500 meters). The type specimen was shot in the afternoon while hunting on a heavily wooded hill slope. It was heard making long, slow leaps over the dry, crisp leaves. Coming to a log, it stood up and rested its fore feet on the log, in which position it was shot by Mr. Goldman.

A specimen from Cerro San Felipe, Oaxaca, is intermediate, both in coloration and cranial characters, between typical *frenatus* and *goldmani*; hence there is little room for doubt that complete intergradation exists between the two.

Measurements.—Type specimen, male adult: Total length, 504; tail vertebræ, 201; hind foot, 58.

PUTORIUS FRENATUS LEUCOPARIA subsp. nov.

Type from Patzcuaro, Michoacan, Mexico. No. $\frac{34914}{47179}$, ♂ ad., U. S. Nat. Mus., Dept. Agric. coll. Collected July 27, 1892, by E. W. Nelson. Original number 2960.

General characters.—Similar to *Putorius frenatus*, but slightly larger; black of head extending posteriorly over neck; white face markings much more extensive; the spot between the eyes very much larger and broadly confluent on both sides with whitish area between eye and ear, which area also is much more extensive in all directions than in *frenatus*.

Color.—Upper parts from shoulders to black tip of tail, dark brown; neck, crown of head, nose, ears, and sides of face to a little behind the eye, black; black of head between eyes and ears divided by a broad band of buffy white which is broadly confluent with buffy yellow of throat and chin; a narrow border of whitish on upper lip; rest of under parts ochraceous yellow (including whole of fore feet, inner sides of hind legs and feet, and terminal half or nearly half of upper surfaces of hind feet, where the color becomes paler, being buffy ochraceous, as on the throat).

Cranial characters.—Skull similar to that of *frenatus*, but larger; audital bullæ much narrower; postorbital processes less strongly developed.

Remarks.—This handsome weasel presents the maximum of black and white markings known in the *frenatus* group, the black of the head reaching back over the neck and the white face markings covering a large area. In the type specimen a white stripe 50 mm. in length extends down the middle of the nape from a point between the ears more than halfway to the shoulders. This, however, is probably abnormal, though a trace of it exists in a female from the same locality. This form is the poorest subspecies described in the present paper, *Measurements.*—Average of 2 males from Patzcuaro (type locality): Total length, 510; tail vertebræ, 201; hind foot, 53. An adult female from same place: Total length, 400; tail vertebræ, 159; hind foot, 42.

PUTORIUS TROPICALIS sp. nov. Tropical Bridled Weasel.

(Pl. III, figs., 5, 5*a*, 6, 6*a*.)

Type from Jico, Vera Cruz, Mexico No. 54994, ♂ ad., U. S. Nat. Mus., Dept. Agric. coll. Collected July 9, 1893, by E. W. Nelson. Altitude 6,000 feet (=1,800 meters). Original number 5195.

Geographic distribution.—The tropical coast belt of southern Mexico and Guatemala from Vera Cruz southward.

General characters.—Similar to *Putorius frenatus*, but much smaller and darker, with the white face markings less extensive, the belly pale orange instead of ochraceous, and under side of tail very much darker.

Color.—Upper parts deep umber brown with a fulvous tone; head, ears, and neck, black, passing gradually into brown of back just in front of the shoulders; terminal one-fourth (or a little more) of tail, black; face markings as in *frenatus*, but less extensive and whiter; under parts ochraceous buff on throat and fore feet, becoming rich orange buff on belly and inner side of thighs, whence (becoming paler) the color reaches out in a narrow interrupted stripe along the inner side of the hind feet to the toes, which are irregularly buffy.

Cranial characters.—Skull of male similar in general to that of *frenatus*, but smaller, relatively longer, with less spreading zygomata, less strongly developed postorbital processes, and probably broader postorbital constriction (the type skull was infested with parasites); audital bullæ smaller and very much narrower; carnassial teeth and upper molar smaller. The skull of the female is very much smaller than that of the male, and has the smoothly rounded brain case of the *cicognani* group, without trace of a sagittal ridge. The squamosals are strongly inflated, resembling those of *cicognani* and the female of *noveboracensis*. It differs from the female *frenatus* in much smaller size, very much smaller audital bullæ, more inflated squamosals, smoothly rounded brain case without trace of sagittal crest, and broader interorbital constriction, which is immediately behind postorbital processes instead of one-fifth the distance from the processes to the occipital crest (fig. 15).

Remarks.—On first examining the skins of this weasel sent home by Mr. Nelson, I supposed it to be merely a tropical subspecies of *frenatus;* but on comparing the skulls I am forced to accord it full specific rank. The difference is greatest in the females, and is really very remarkable, as may be seen from the accompanying figures (figs. 15 and 16). The female of *frenatus* (fig. 16) resembles the male of the same species (pl. III, fig. 1), while the female of *tropicalis* (fig. 15) resembles the *cicognani* group—representing another section of the genus. The case is parallel to that of *P. noveboracensis* already described. The female of *tropicalis*, like that of *noveboracensis*, shows arrested development or absence of the specialization that characterizes the male, while the females of *washingtoni* and *frenatus* have advanced further and are more like the male. In the case of the female skulls of *frenatus* and *tropicalis* here figured, it is interesting to know that they were taken within a few miles of one another—*frenatus* on Cofre de Perote. at an altitude of about 12,500 feet; *tropicalis* at Jico on the plain below, at an altitude of 5,000 or 6,000 feet.[1]

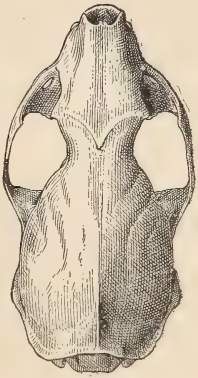


FIG. 15—*P. frenatus* ♀.

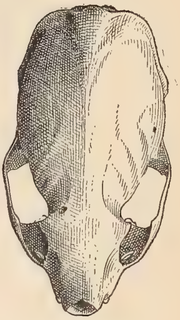


FIG. 16.—*P. tropicalis* ♀.

The Department collection contains four specimens of this weasel, all collected by Mr. Nelson in Vera Cruz. Three of them, two adult males and one old female, are from Jico; the fourth, an immature female, is from Catemaco, and presents the extreme of differentiation in intensity of color. The hind feet are dark throughout and the color of the upper parts is peculiarly dark and rich, as in *P. affinis.*

Measurements.—Average of two adult males from Jico, Vera Cruz (type locality): Total length, 442; tail vertebræ, 175; hind foot, 50. An old female from same place: Total length, 333; tail vertebræ, 121; hind foot, 37.

PUTORIUS AFFINIS (Gray).

Mustela affinis Gray: Annals & Mag. Nat. Hist., 4th ser., XIV, p. 375, Nov., 1874.

Type locality.—"New Granada" [= Colombia].

General characters.—Size large; tail long; color very dark, almost black anteriorly; facial markings obsolete or nearly so.

Color.—Upper parts nearly pure black on head and neck, fading imperceptibly to rich blackish brown on back, rump, and tail; black tip of tail long, but not strongly contrasted with dark color of rest of tail; under parts narrowly ochraceous orange, narrowest behind angle of mouth, where it is encroached on by the blackish of the cheeks. Face usually unmarked, but a whitish streak sometimes present in front of ear.

Cranial characters.—The only skull of this weasel I have seen is from a skin (No. 13770, U. S. Nat. Mus.) collected by Dr. Van Patten, at San Jose, Costa Rica. It is immature, but differs strikingly from *frenatus* in the greater breadth of the frontal region and the flatness of the audital bullæ. The constriction is little marked, which may be due to parasites in the frontal sinuses. The young skull affords the following measurements: Basal length, 50; zygomatic breadth, 29; postpalatal length, 26; palatal length, 24; interorbital breadth, 12; breadth across postorbital processes, 15; breadth of constriction, 14.

---

[1] The difference in size of the two species is well shown by the flesh measurements of these two specimens. Female *frenatus*, Cofre de Perote: Total length, 418; tail vertebræ, 160; hind foot, 45. Female *tropicalis*, Jico: Total length, 333; tail vertebræ, 121; hind foot, 37.

General remarks.—There are several specimens from Costa Rica in the National Museum collection which apparently belong to this species. In these specimens the color of the upper parts is exceedingly dark from the color of the tips of the hairs; but the color immediately underlying the black tips is deep fulvous brown, giving a very rich tone to the pelage. The orange of the under parts is narrow and does not reach the feet; on the hind legs it stops on the thighs, and on the forelegs it stops short of the wrists.

Measurements (from dry skins in U. S. Nat. Mus.).—Total length, about 510; tail vertebræ, about 180; hind foot, about 52.

Table of average cranial measurements of North American Weasels.

Name.	Locality.	Sex.	Basal length.	Basilar length of Hensel.	Zygomatic breadth.	Mastoid breadth.	Breadth across post-orbital processes.	Interorbital breadth.	Foramen magnum to plane of last molars.	Palatal length.	Postpalatal length.	Number of skulls in average.
P. cicognani	Ossipee, N. H	♂	38.5	37.5	21	18.5	10.5	8.7	25.5	16.5	22	4
	Elk River, Minn	♂	40.2	39	22	19.5	11	9	26.5	17	22.5	4
	Do	♀	33.5	32.5	18	16	10	7.8	22	14	19.5	1
	Mount Forest, Ontario	♀	32.5	31.5	17.5	16	9	7	21.5	14	18	1
P. richardsoni	Great Slave Lake	♂	41.5	40	24	20.5	11.5	9.7	27	18	23	3
P. alascensis	Juneau, Alaska	♂	43	42	24.5	21	14	11	28.5	19	24	1
P. streatori	Skagit Valley, Wash	♂	35	34	20	18	11	8.5	23	15	20	1
	Do	♀	30	29.5	16.5	15	10	7.5	20	12	18	1
	Trout Lake, Wash	♂	33.5	32.5	18	16.5	9.8	8	22	14.5	19.5	3
	Do	♀	28.5	28	15.5	13.5	8.5	6.5	19	12.5	16.5	1
P. rixosus	Osler, Saskatchewan	♀	[1]26.5	[1]26	14.2	13.5	7.5	5.5	17.5	11	[1]15	1
P. arcticus	Point Barrow, Alaska	♂	44.5	43	29.5	23	14.5	12.5	29	20.5	24	1
	Franklin Bay, Arctic Coast.	♂	43.5	42	27.5	22.5	13	11	28.5	19.5	24	1
	St. Michaels, Alaska	♂	43	42	26.5	22.5	13.5	12	28	19.5	24	1
	Do	♀	38	37	22.5	19	12	10	24.5	16.5	21	1
P. kadiacensis	Kadiak Island, Alaska	♂	[1]42	[1]41	24	20.5	12.5	10.5	[1]27	17.5	[1]24	1
P. noveboracensis	Adirondacks, N. Y	♂	47	45.5	27	23.5	14.5	11.3	30	21.5	25.5	5
	Do	♀	38.5	37.5	20	18.5	11	8.5	25.5	16	22.5	1
P. washingtoni	Trout Lake, Wash	♂	44.2	43	26	23	12.5	10.2	27.5	21	23	7
	Do	♀	38.3	37.5	21.5	20	10.5	8.7	24	17.8	20.5	4
P. peninsulæ	Tarpon Springs, Fla	♀	45.5	44	27	24	14	11	29	21	24.5	1
P. longicauda	Carlton House, Saskatchewan.	♂	48	47	30.5	26	15.5	11.5	30	23	25	1
	Do	♀	43.5	42.5	26	23	12	10.5	26.5	20.5	22.5	1
P. spadix	Elk River, Minn	♂	48	46.5	29.5	26	14.5	11.5	30	23.5	24	1
	Do	♀	44	43	26	23.5	13	10.5	28	20.5	23.5	1
P. saturatus	Siskiyou Mountains, Oregon.	♂	45	44	29	25	14	11	28.5	21	24	2
P. arizonensis	Springerville, Ariz	♂	42	41	26	23	12.5	10.5	26.5	20	22	1
	Boulder County, Colo	♂	44	43	28.5	23	13	10.5	27	20.5	23.5	1
	Sierra Nevada, Cal	♂	44.5	43.5	28	23	14.5	10.5	28	21	23	4
	Do	♀	39.5	38	22.5	20.5	11.3	9	24	18	21	3
P. alleni	Black Hills, S. Dak	♂	42	40.8	27	22	13.2	11	26.2	20	22	2
	Do	♀	38.5	37.5	23	.....	12	9	24.5	18	20.5	1
P. xanthogenys	Southern California	♂	44	42.5	27.5	23.5	13.5	9.5	27.5	20.5	23.2	2
	Do	♀	42	41	24	22.5	12	9.5	26	19.5	22	1
P. frenatus	Tlalpam, Mexico	♂	52.5	51	33.5	27.5	15.5	12	33.5	24.5	27.5	1
	Cofre de Perote, Mexico.	♀	45	43.5	25.5	23	13	10	29	19.5	25	1
P. tropicalis	Jico, Vera Cruz, Mexico.	♂	49	47.5	28	24.5	15	10.5	32	22	27	1
	Do	♀	37.5	36.5	22.5	19.5	12	9	24.5	16	21.5	1

[1] Estimated.

INDEX.

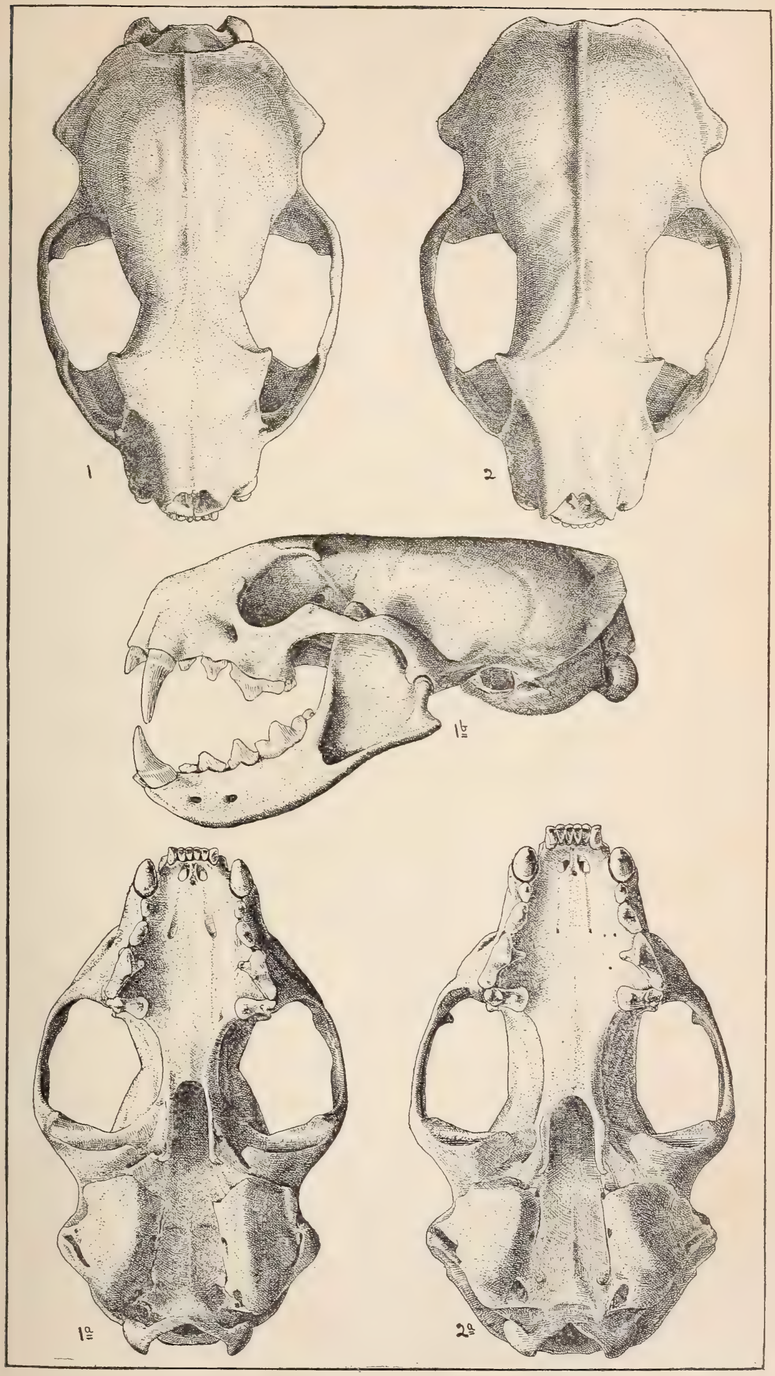
[Synonyms in italics.]

Arctogale, 9.
Cynomyonax (synonym of Putorius), 7.
Gale (synonym of Ictis), 9.
Ictis, subgenus, 9.
    list of species, 10.
Mustela brasiliensis, 26.
    cicognani, 10.
    erminea, 9.
    erminea, 11.
    frenata, 26.
    longicauda, 19.
    richardsoni, 11.
    vulgaris, 9.
    vulgaris, 10.
    xanthogenys, 25.
Putorius, genus, 7.
    key to subgenera, 7.
    list of species with type localities, 10.
    subgenus, 7.
    table of cranial measurements, 33.
Putorius affinis, 31–32.
    alascensis, 12–13.
    alleni, 24.
    arcticus, 15–16.
    arizonensis, 22–24.
Putorius boccamela, 9.
    cicognani, 10–11.
    erminea, 15, 16.
    erminea, 16.
    eversmanni, 8.
    frenatus, 26–28.
    goldmanni, 28–29.
    kadiacensis, 16.
    leucoparia, 29.
    longicauda, 19–21.
    nigripes, 7–9.
    noveboracensis, 16–18.
    oregonensis, 25–26.
    peninsulæ, 19.
    pusillus, 14.
    putorius, 8.
    richardsoni, 11–12.
    rixosus, 14–15.
    saturatus, 21–22.
    spadix, 21.
    streatori, 13–14.
    tropicalis, 30–31.
    vulgaris, 10.
    washingtoni, 18–19.
    xanthogenys, 25.

PLATE I.

FIG. 1. *Putorius nigripes*, ♂ ad., Trego County, Kans.
(No. 4143, Merriam coll.)
1. Upper side of skull.
1*a*. Under side of skull.
1*b*. Side view of skull.

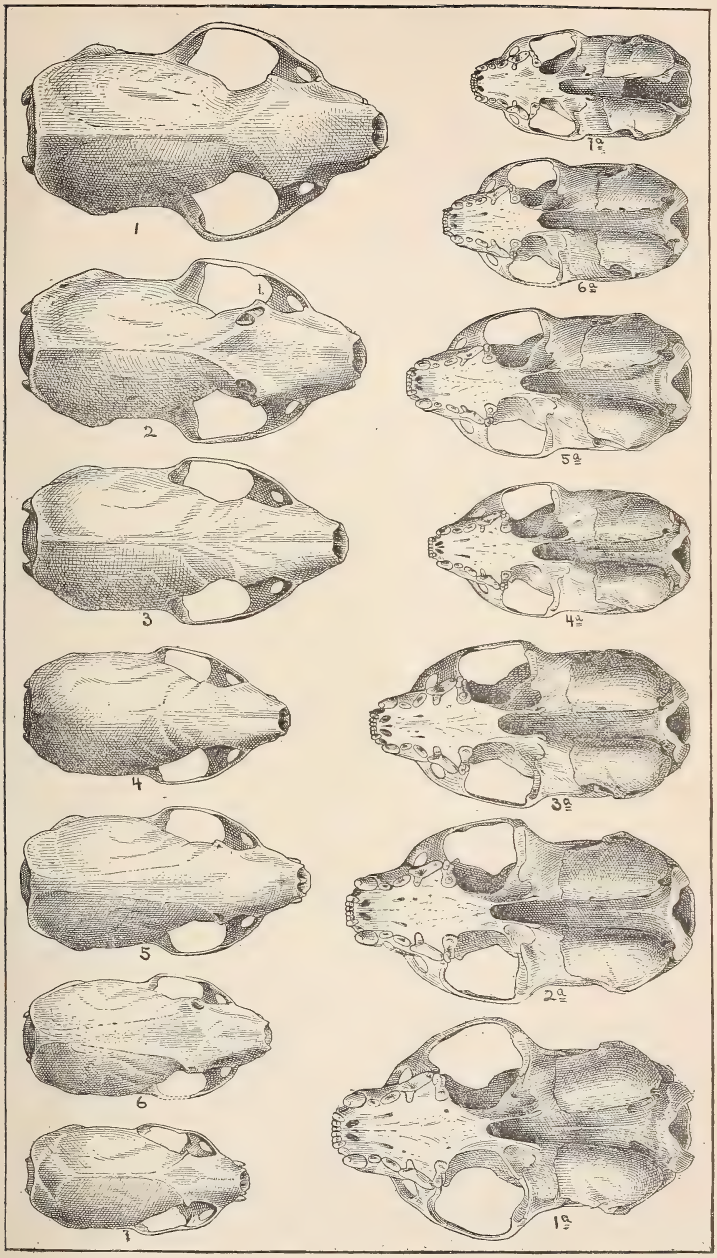
2. *Putorius putorius*, ♂ ad., Brunswick, Germany.
(No. 4661, Merriam coll.)
2. Upper side of skull.
2*a*. Under side of skull



1. *Putorius nigripes* ♂ ad. Trego County, Kansas.
2. *Putorius putorius* ♂ ad. Brunswick, Germany.

PLATE II.

FIG. 1. *Putorius arcticus.* Point Barrow, Alaska (type).
♂ ad., No, 23010, U. S. Nat. Mus.
2. *Putorius alascensis.* Juneau, Alaska (type).
♂ ad., No. 74423, U. S. Nat. Mus., Dept. Agric. coll.
3 and 4. *Putorius cicognani.*
3. ♂ ad., Bucksport, Me., No. 4247, Bangs coll.
4. ♀ ad., Mount Forest, Ontario, No. 789, Bangs coll.
5 and 6. *Putorius streatori.* Mount Vernon, Skagit Valley, Wash.
5. ♂ ad., No. 76646, U. S. Nat. Mus., Dept. Agric. coll. (type).
6. ♀ ad., No. 76623, U. S. Nat. Mus., Dept. Agric. coll.
7. *Putorius rixosus.* Osler, Saskatchewan.
♀ ad., No. 642, Bangs coll. (type).



1. *Putorius arcticus.*
2. *P. alascensis.*
3, 4. *P. cicognani.*
5, 6. *P. streatori.*
7. *P. rixosus.*

PLATE III.

Figs. 1 and 2. *Putorius frenatus.*

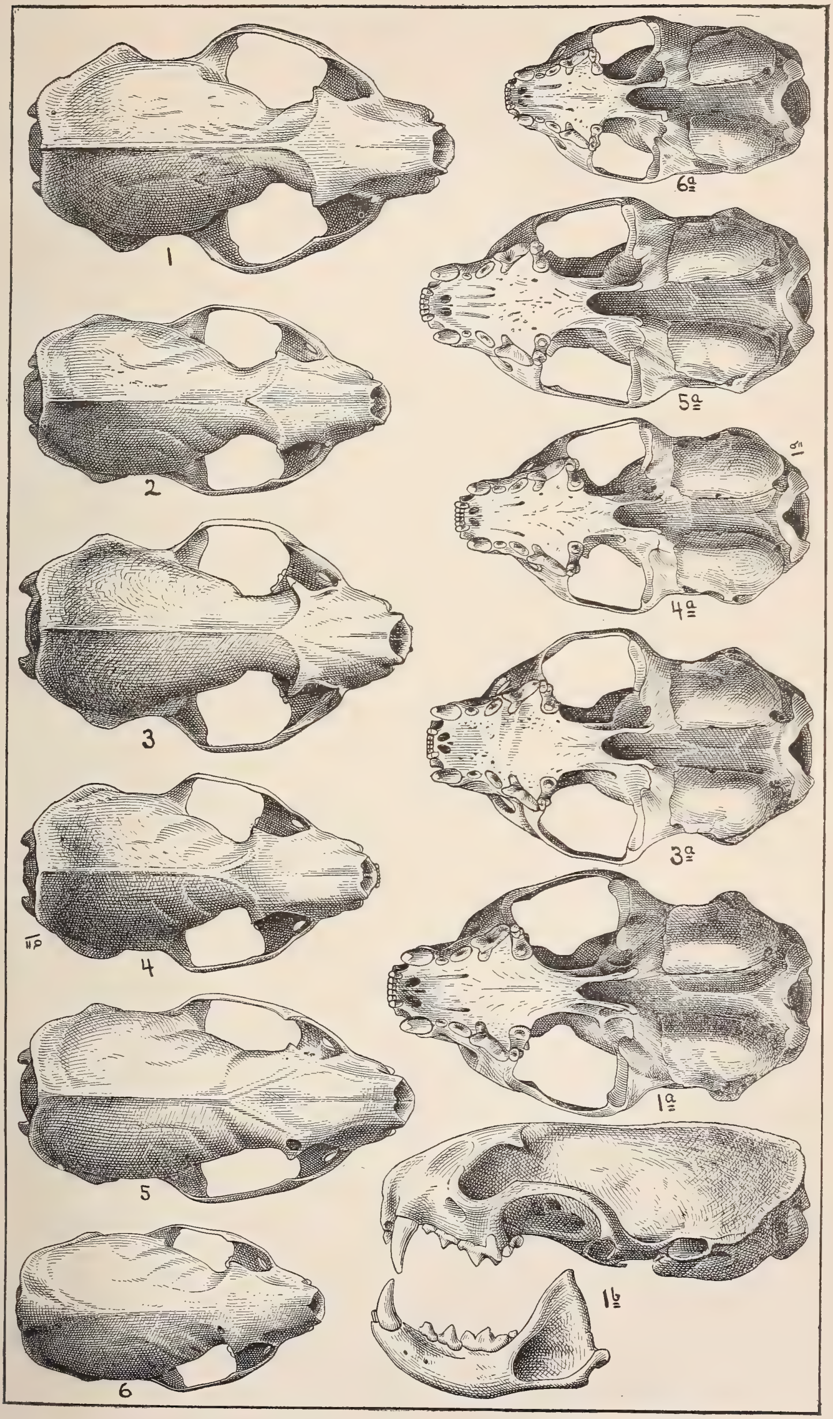
1. ♂ ad., Tlalpam, Mexico, No. 50826, U. S. Nat. Mus., Dept. Agric. coll.
2. ♀ ad., Cofre de Perote, Vera Cruz, Mexico, No. 54278, U. S. Nat. Mus., Dept. Agric. coll.

3 and 4. *Putorius longicauda.* Carlton House, Saskatchewan (type locality).

3. ♂ ad., No. 73183, U. S. Nat. Mus., Dept. Agric. coll.
4. ♀ ad., No. 75483, U. S. Nat. Mus., Dept. Agric. coll.

5 and 6. *Putorius tropicalis.* Jico, Vera Cruz, Mexico.

5. ♂ ad., No. 54994, U. S. Nat. Mus., Dept. Agric. coll. (type).
6. ♀ ad., No. 54993, U. S. Nat. Mus., Dept. Agric. coll.



1, 2. *Putorius frenatus.* 3, 4. *P. longicauda.* 5, 6. *P. tropicalis.*

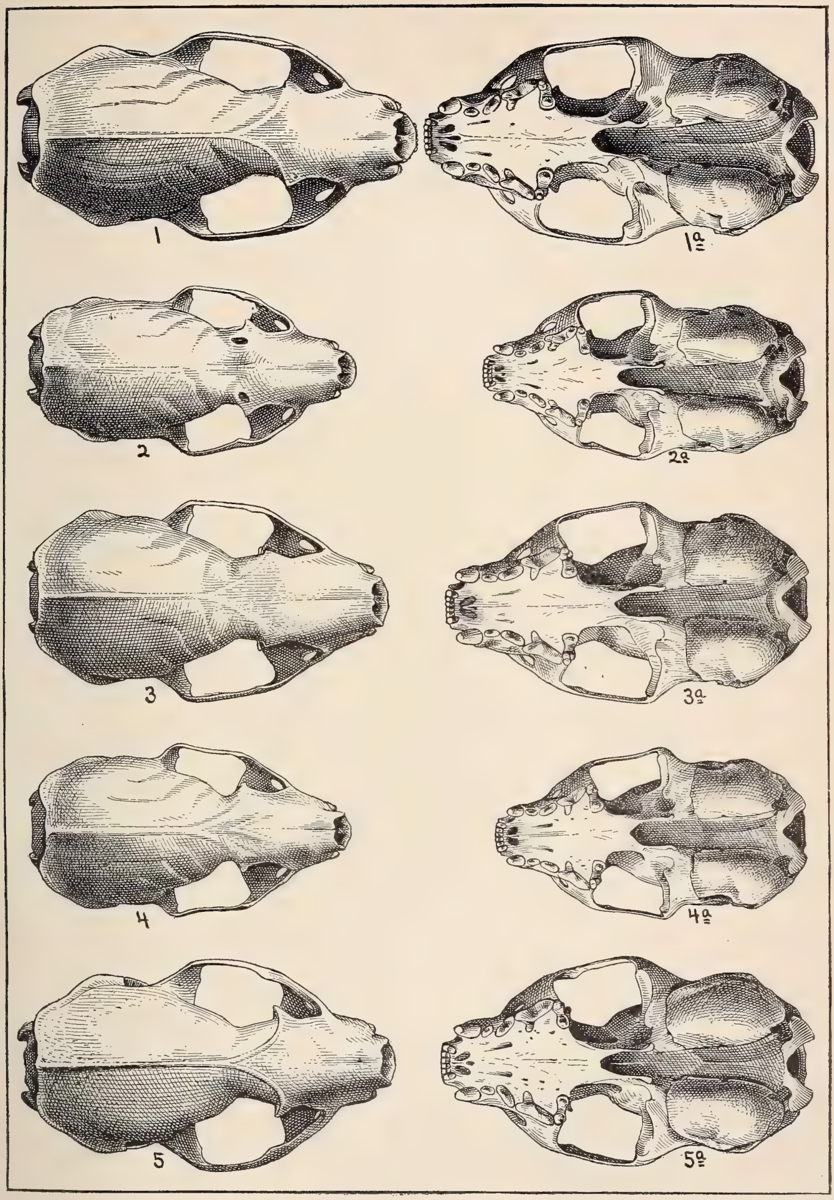
PLATE IV.

FIGS. 1 and 2. *Putorius noveboracensis.* Adirondacks, New York.
1. ♂ ad., No. 3843, Merriam coll.
2. ♀ ad., No. 5598, Merriam coll.

3 and 4. *Putorius washingtoni.* Trout Lake, Washington.
3. ♂ ad., No. 76322, U. S. Nat. Mus., Dept. Agric. coll. (type).
4. ♀ ad. No. 67321, U. S. Nat. Mus., Dept. Agric. coll.

5. *Putorius peninsulæ.* Tarpon Springs, Fla.
♀ ad., No. 2379., Rhoads coll.

PLATE IV.



1, 2. *Putorius noveboracensis.* 3, 4. *P. washingtoni.* 5. *P. peninsulæ.*

PLATE V.

Fig. 1. *Putorius longicauda* (Bonap.).
- 1. ♂ ad., Carlton House, Saskatchewan, No. 73183, U. S. Nat. Mus., Dept. Agric. coll.
- 1*a*. ♀ ad., Carlton House, Saskatchewan, No. 75483, U. S. Nat. Mus., Dept. Agric. coll.

2. *Putorius cicognani* (Bonap.).
- 2. ♂, Bucksport, Me. No. 4247, Bangs coll.
- 2*a*. ♀, Mount Forest, Ontario No. 789, Bangs coll.

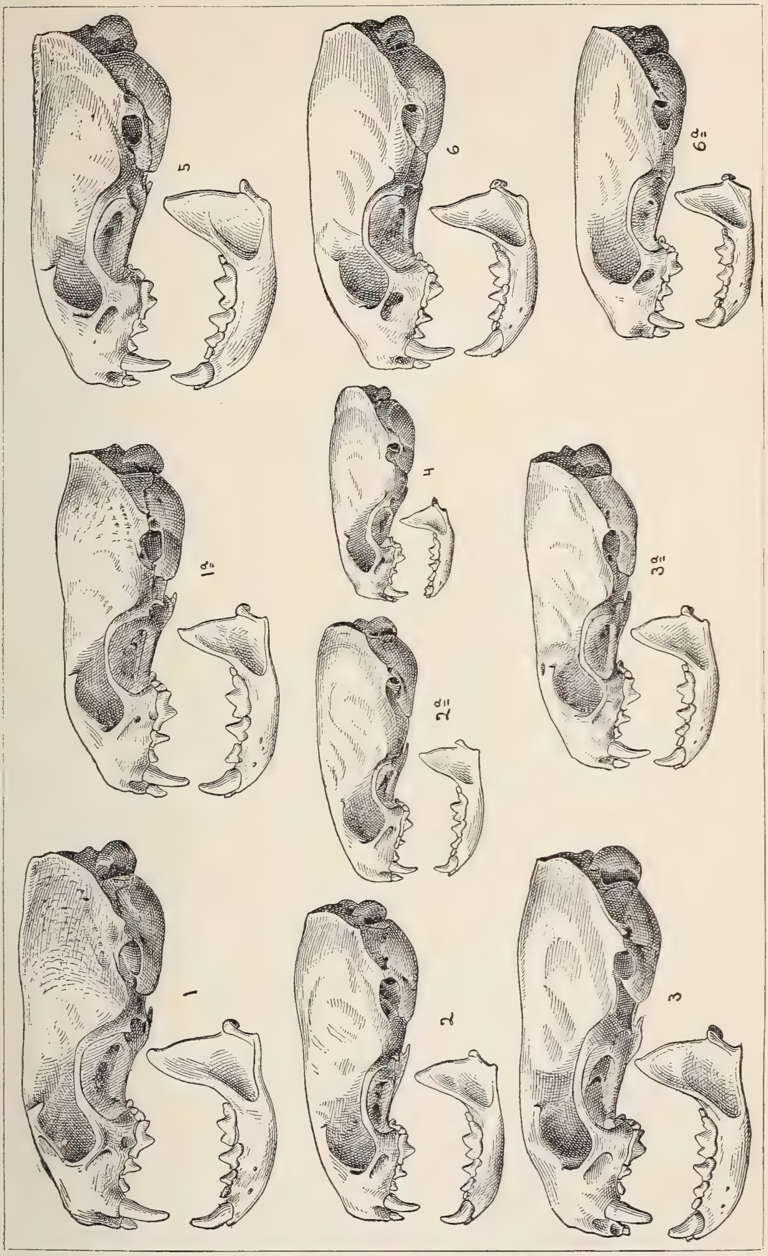
3. *Putorius noveboracensis* De Kay.
- 3. ♂ ad., Adirondacks, New York No. 3843, Merriam coll.
- 3*a*. ♀ ad., Adirondacks, New York No. 5598, Merriam coll.

4. *Putorius rixosus* nob.
- ♀ ad. (type), Osler, Saskatchewan, No. 642, Bangs coll.

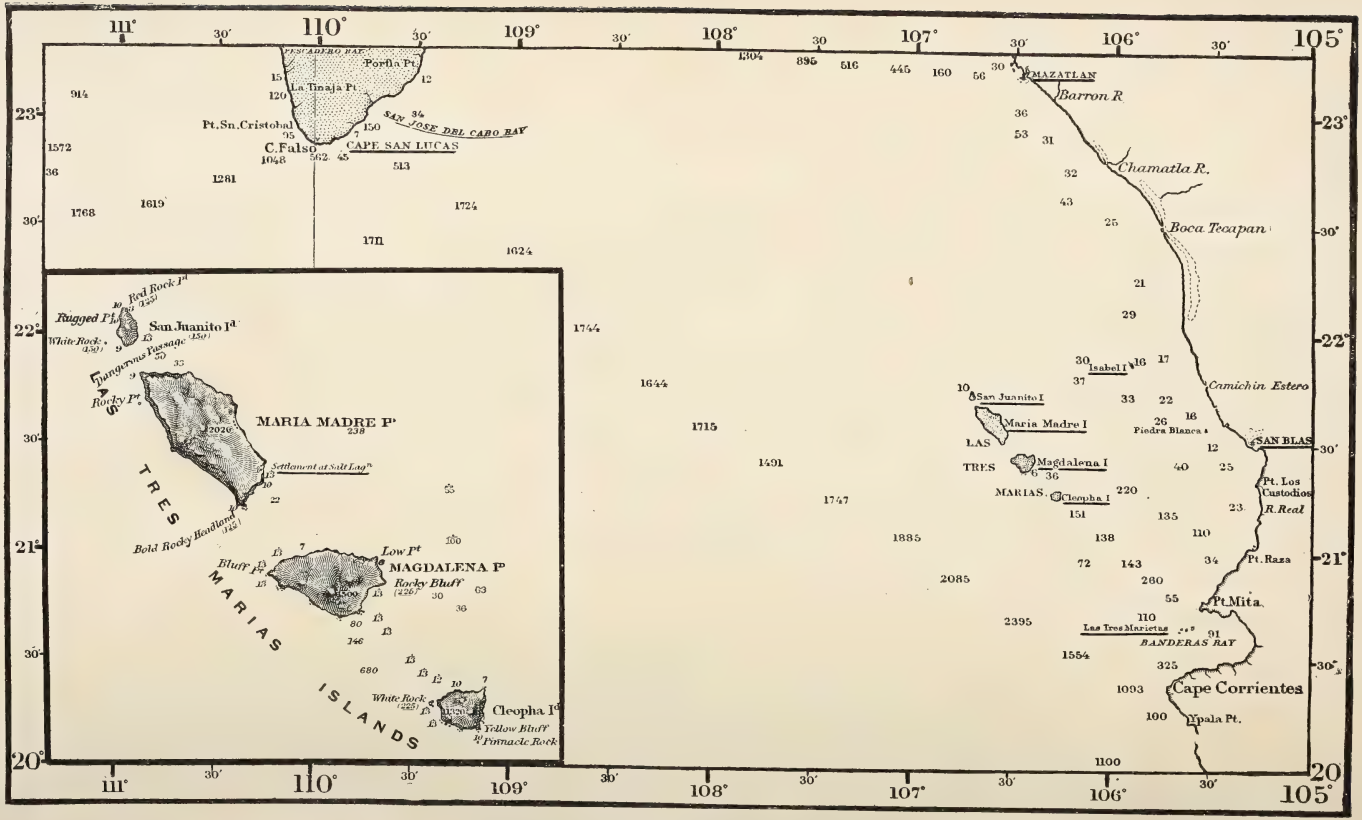
5. *Putorius peninsulæ* Rhoads.
- ♀ old, Tarpon Springs, Fla. No. 2379, Rhoads coll.

6. *Putorius arcticus* sp. nov.
- 6. ♂, St. Michaels, Alaska No. 36243, U. S. Nat. Mus.
- 6*a*. ♀, St. Michaels, Alaska No. 36246, U. S. Nat. Mus.

PLATE V.



1. *Putorius longicauda.* 2. *P. cicognani.* 3. *P. noveboracensis.* 4. *P. rixosus.* 5. *P. peninsulæ.* 6. *P. arcticus.*



Map of the Tres Marias Islands, Mexico.

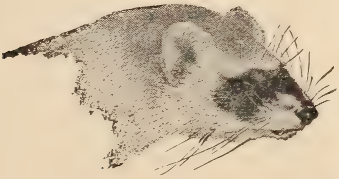
(From charts of the U S. Hydrographic Office. Elevations are in feet; soundings in fathoms.)

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 12

[Actual date of publication, July 23, 1896.]



GENERA AND SUBGENERA OF VOLES AND LEMMINGS

BY

GERRIT S. MILLER, Jr.

Prepared under the direction of
Dr. C. HART MERRIAM
CHIEF OF DIVISION OF ORNITHOLOGY AND MAMMALOGY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
DIVISION OF ORNITHOLOGY AND MAMMALOGY,
Washington, D. C., May 12, 1896.

SIR: I have the honor to transmit herewith, and recommend for publication, the manuscript of No. 12 of North American Fauna, treating of the Genera and Subgenera of Voles and Lemmings, and comprising results of investigations carried on in the Division of Ornithology and Mammalogy by Gerrit S. Miller, jr.

Respectfully,

C. HART MERRIAM,
Chief of Division.

DR. CHAS. W. DABNEY, JR.,
Acting Secretary of Agriculture.

CONTENTS.

	Page.
Introduction	7
The subfamily *Microtinæ* and its main divisions	8
List of genera and subgenera of *Microtinæ*	9
Geographic distribution	9
Habits	10
Nomenclature	11
History of former classifications	19
Characters on which the present classification of the subgenera of *Microtus* is based	24
Keys	28
Descriptions of living genera and subgenera	32
Descriptions of extinct genera and subgenera	73
Note on '*Arvicola*' *intermedius* Newton	75

ILLUSTRATIONS.

PLATES.

1. Skulls of *Microtus macropus, M. pinetorum, M. arvalis, M. curtatus, M. oregoni, M. terrestris, M. albicauda, M. fertilis, Evotomys gapperi, Phenacomys oramontis, Lemmus nigripes, Synaptomys wrangeli, S. helaletes, Dicrostonyx torquatus.*
2. Bony palates of *Phenacomys, Microtus, Lagurus, Pitymys, Arvicola, Alticola, Anteliomys, Eothenomys, Evotomys, Neofiber, Dicrostonyx, Lemmus, Fiber.*
3. Mandibles of *Synaptomys, Phenacomys, Microtus, Evotomys.*

TEXT FIGURES.

1. First upper molar of six specimens of *Microtus pennsylvanicus.*
2. Second upper molar of six specimens of *Microtus pennsylvanicus.*
3. Third upper molar of eighteen specimens of *Microtus pennsylvanicus.*
4. First lower molar of eighteen specimens of *Microtus pennsylvanicus.*
5. Second lower molar of four specimens of *Microtus pennsylvanicus.*
6. Third lower molar of four specimens of *Microtus pennsylvanicus.*
7. Palatal view of skull of *Microtus arvalis* and *Evotomys gapperi.*
8. Enamel pattern of molar teeth of *Synaptomys cooperi.*
9. Palatal view of skulls of *Synaptomys* and *Mictomys.*
10. Enamel pattern of molar teeth of *Synaptomys innuitus.*
11. Enamel pattern of molar teeth of *Lemmus lemmus.*
12. Left front foot of *Lemmus lemmus.*

13. Enamel pattern of *Dicrostonyx* from Ungava.
14. Ear of *Dicrostonyx* and *Lemmus*.
15. Left front foot of three specimens of *Dicrostonyx* from Alaska, showing seasonal change in form of middle claws.
16. Side view of molars of adult and young *Phenacomys*.
17. Enamel pattern of molar teeth of *Phenacomys celatus*.
18. Side view of molars of adult and young *Evotomys*.
19. Enamel pattern of molar teeth of *Evotomys gapperi*.
20. Side view of molars of adult *Microtus*.
21. Left front foot of *Microtus terrestris*.
22. Enamel pattern of molar teeth of *Microtus* (*Eothenomys*) *melanogaster*.
23. Enamel pattern of molar teeth of *Microtus* (*Anteliomys*) *chinensis*.
24. Audital bullæ of *Microtus* (*Microtus*) *arvalis* and *M.* (*Lagurus*) *pallidus*.
25. Enamel pattern of molar teeth of *Microtus* (*Lagurus*) *luteus*, *M.* (*L.*) *lagurus*, and *M.* (*L.*) *pallidus*.
26. Enamel pattern of molar teeth of *Microtus* (*Alticola*) *albicauda*.
27. Audital bullæ of *Microtus* (*Alticola*) *albicauda* and *M.* (*Hyperacrius*) *fertilis*.
28. Enamel pattern of molar teeth of *Microtus* (*Hyperacrius*) *fertilis*.
29. Enamel pattern of molar teeth of *Microtus* (*Pedomys*) *austerus*.
30. Enamel pattern of molar teeth of *Microtus* (*Phaiomys*) *strauchi*.
31. Enamel pattern of molar teeth of *Microtus* (*Pitymys*) *pinetorum* and *M.* (*P.*) *savii*.
32. Enamel pattern of molar teeth of *Microtus* (*Chilotus*) *oregoni*.
33. Enamel pattern of molar teeth of *Microtus* (*Microtus*) *arvalis*, *M.* (*M.*) *nivalis*, *M.* (*M.*) *pennsylvanicus*, and *M.* (*M.*) *ratticeps*.
34. Enamel pattern of molar teeth of *Microtus* (*Arvicola*) *terrestris* and *M.* (*A.*) *macropus*.
35. Enamel pattern of front lower molar of type of *Microtus arvicoloides*.
36. Enamel pattern of molar teeth of *Microtus* (*Neofiber*) *alleni*.
37. Dorsal view of skull of *Fiber*.
38. Side view of molars of adult *Fiber*.
39. Enamel pattern of molar teeth of *Fiber zibethicus*.
40. Enamel pattern of molar teeth of '*Arvicola*' *intermedius*.

No. 12. NORTH AMERICAN FAUNA. July, 1896.

THE GENERA AND SUBGENERA OF VOLES AND LEMMINGS.

By GERRIT S. MILLER, JR.

The following revision of the genera and subgenera of voles and lemmings is chiefly the result of a study made in the Division of Ornithology and Mammalogy of the collections belonging to the United States Department of Agriculture. This material has been supplemented by specimens from my own private collection and those of Mr. Outram Bangs, Mr. S. N. Rhoads, and Dr. C. Hart Merriam. I have also had access to the voles and lemmings in the American Museum of Natural History, the United States National Museum, and the British Museum. Thanks are due to all who have placed material at my disposal, and especially to Mr. Oldfield Thomas, curator of mammals in the British Museum.

Hitherto no attempt has been made to compare in detail the voles and lemmings of the Old and New Worlds. This is the necessary result of the poor quality and small number of specimens from the opposite side of the Atlantic to be found in museums and private collections in both Europe and America. In consequence of this lack of material, writers who have been thoroughly acquainted with indigenous voles and lemmings have either made no comparison of these with exotic forms, or have reached faulty or at least incomplete conclusions with regard to groups occupying widely separated geographic regions.

For determining the relationships of the different voles and lemmings the collection in the British Museum offers exceptional facilities. It contains representatives of all the recent genera and subgenera found in the Old World, and lacks only one of those peculiar to America. The collection is, moreover, especially rich in specimens identified by the more prominent writers on the subject—a circumstance of the utmost importance.

The drawings for the illustrations in this paper, except fig. 9 and Pls. I and II, were made under my constant supervision by Mr. F. Müller. Pls. I and II were prepared by Dr. James C. McConnell. Figs. 4, 5, 8, and 10 of Pl. II were drawn in ink by Dr. McConnell from pencil drawings made at the British Museum by Mr. Hollick. Fig. 7 of the same plate is by Dr. McConnell from a pencil drawing by Mr. A.

Westergren. The tracings of the enamel pattern of *Microtus luteus* and *M. lagurus* are enlarged from figs. 10, 11, 15, and 16 of Pl. XIII of Büchner's 'Wissenschaftliche Resultate der von N. M. Przewalski nach Central-Asien unternommenen Reisen.' In fig. 22 the enamel patterns of the front lower molar and middle and back upper molars are enlarged from Mr. Hollick's pencil drawing of a specimen from Fokien, China (British Museum Register 92. 10. 12. 52), the other teeth from fig. 1, Pl. XLVI of Milne-Edwards's 'Recherches pour servir à l'Histoire Naturelle des Mammifères.' Fig. 23 is compounded in the same way from Mr. Hollick's drawing and the original figure published by Thomas.

THE SUBFAMILY MICROTINÆ AND ITS MAIN DIVISIONS.

The subfamily *Microtinæ*[1] is a group of murine rodents closely related to the *Neotominæ*, *Cricetinæ*, and *Myotalpinæ*.[2] It is distinguished from the first and second by cranial and dental characters; from the last chiefly by peculiarities in external form.[3] While it is not the purpose of the present paper to discuss the relationships of the *Microtinæ* to any of these, it is important to consider in some detail the larger divisions of the subfamily itself before taking up the genera and subgenera.

The members of the subfamily *Microtinæ* fall naturally into two supergeneric groups, the *Lemmi* and *Microti*, or lemmings and voles. The former includes the genera *Synaptomys*, *Lemmus*, and *Dicrostonyx*, the latter the genera *Phenacomys*, *Evotomys*, *Microtus*, and *Fiber*.

Lemmi.—Skull generally broad and massive; lower incisors short, with roots ending on inner side of molars (Pl. III, fig. 1); crowns of maxillary teeth scarcely, if at all, narrower posteriorly than anteriorly (figs. 10, 11, and 12); tail usually shorter than hind foot (in *Synaptomys* slightly longer); palms and soles usually without distinct tubercles.

Microti.—Skull comparatively slender and lightly built; lower incisors long, with roots ending on outer side of molars (Pl. III, figs. 2 and 3); crowns of maxillary teeth distinctly narrower posteriorly than anteriorly (figs. 17, 19, 21–35); tail usually much longer than hind foot (in the Asiatic species of *Lagurus* distinctly shorter); palms and soles always with distinct tubercles.

In external appearance the lemmings and voles differ considerably. The former are mostly thick-set animals, with powerful fossorial feet, long, dense fur and very short tails, while the latter are more slender, with longer tails and with the fur and feet not so highly modified.

---

[1] = *Arvicolinæ* Auct. This name, however, must be abandoned, together with the generic name *Arvicola* (see p. 14).

[2] = *Siphneinæ* Auct. As *Siphneus* (Brants, 1827) must give place to *Myotalpa* (Kerr, 1792) (see Allen, Bull. Am. Mus. Nat. Hist., New York, VII, p. 183, 1895) it is necessary to make a corresponding change in the name of the subfamily.

[3] The characters separating the *Myotalpinæ* from the *Microtinæ* are of much less importance than those separating the latter from any of its other allies. So close, indeed, is the resemblance between the two that it may eventually prove necessary to unite them under one name. Lack of material prevents any final conclusion at present.

Although the voles and lemmings may usually be distinguished at a glance, there are certain genera and subgenera the exact position of which is not at first apparent. Thus the species of *Lagurus*, although voles, so closely resemble lemmings in external appearance that their true relationships have been only very recently detected. On the other hand, *Synaptomys*, a true lemming, has much the superficial appearance of certain forms of *Microtus*.

LIST OF GENERA AND SUBGENERA OF MICROTINÆ.

Genera.	*Subgenera.*	*Types.*
Synaptomys.		Synaptomys cooperi.
	Mictomys.	Synaptomys innuitus.
Lemmus.		Lemmus lemmus.
Dicrostonyx.		Dicrostonyx torquatus.
Phenacomys.		Phenacomys intermedius.
Evotomys.		Evotomys rutilus.
Microtus.		Microtus arvalis.
	Eothenomys.	Microtus melanogaster.
	Anteliomys.	Microtus chinensis.
	Lagurus.	Microtus lagurus.
	Alticola.	Microtus stoliczkanus.
	Hyperacrius.	Microtus fertilis.
	Phaiomys.	Microtus blythii.
	Pedomys.	Microtus austerus.
	Pitymys.	Microtus pinetorum.
	Chilotus.	Microtus oregoni.
	Microtus.	Microtus arvalis.
	Arvicola.	Microtus terrestris.
	Neofiber.	Microtus alleni.
Fiber.		Fiber zibethicus.

The following groups are known to occur in both hemispheres:

Lemmus.
Dicrostonyx.
Phenacomys?
Evotomys.
Microtus (genus and subgenus).
Lagurus.
Pitymys.
Arvicola.

The following groups have been found in the Old World only:

Eothenomys.
Anteliomys.
Phaiomys.
Alticola.
Hyperacrius.

The following groups have been found in America only:

Synaptomys.
Mictomys.
Pedomys.
Chilotus.
Neofiber.
Fiber.

GEOGRAPHIC DISTRIBUTION.

The subfamily *Microtinæ* is distributed throughout the extratropical region of the Northern Hemisphere. In the north some members of the group approach the extreme limit of mammalian life, while in the south a few species enter the northernmost edge of the tropics. The subfamily, which is clearly boreal in origin, reaches its highest development in temperate Europe, Asia, and North America. Although it is probable that no species are common to both continents, five genera and four subgenera of the genus *Microtus* have a circumpolar distribution. On the other hand, no genera are peculiar to the Old World, and only two are confined to America. Asia has five subgenera of *Microtus* not found in America, and America has three not known to occur in the Old World.

HABITS.

The voles and lemmings occur in great abundance throughout the region which they occupy. They live in an endless variety of situations, from sea beaches to marshes and Alpine mountain tops, and from open plains to the densest forests. They are, perhaps, most numerous in well-watered grass lands. In localities where they are abundant most of the species make their presence known by trails or runways traced through the vegetation near their burrows. Occasionally, however, they occupy hollows in decaying logs or among loose rocks, and use natural crevices instead of beaten paths. While the great majority of species spend much of their time on the surface, protected by the overhanging vegetation, a few live almost exclusively underground, and in consequence of this habit have acquired numerous modifications which fit them for the needs of a subterranean life. Others are amphibious and never occur at any great distance from water. At least one member of the subfamily[1] is said to live among the branches of trees. The food is chiefly vegetable, though most species occasionally eat animal food. The vegetable food consists principally of grass stems, though roots, bark, leaves, seeds, and fruit are at times eaten in varying quantities. As voles are readily caught in traps baited with meat, it is probable that flesh forms part of their normal food. Mollusks are eaten freely when they can be obtained.

The voles and lemmings breed very rapidly during the warmer part of the year. The number of young in a litter varies from one or two to ten. Five is, perhaps, the average number in the majority of species, though it is probably less in those in which the females have only four mammæ.

---

[1] *Phenacomys longicauda* True, from Oregon. In the original description of the species (Proc. U. S. Nat. Mus., XIII, pp. 303–304, Nov. 15, 1890) Mr. True quotes as follows from a letter from Mr. Aurelius Todd, who collected the type specimen: "It lives exclusively, as far as I have been able to ascertain, among the boughs and branches of the Oregon pine trees (*Abies douglasi*), making a nest of a size smaller than a robin's nest. It is usually situated on the upper side of a medium-sized branch, perhaps 6 inches in diameter, and is composed of the leaves of the tree deftly split in two from one end to the other and dried. The nest is neatly and rather ingeniously made, and the sameness of the material is a novelty. * * * The mouse is almost exclusively arboreal in its habits, but I think that I have reason to believe that they sometimes come to the ground for food, as I have seen tracks in the snow around the trees which I think were made by these little animals. They could be tracked up and down the tree, but to no great distance from it, and were most likely in search of food."

The young are born in nests made of soft vegetable fibers. The nests are usually placed in a burrow or beneath shelter of some kind and vary with the size of the animals, but are usually about 200 mm. in diameter. The species of *Fiber* make nests containing several bushels of material. These are conspicuous objects in the marshes where the animals live. Under conditions the nature of which is not understood the rate of increase in certain species is occasionally so enormously accelerated that an area becomes overcrowded and the animals wander into the surrounding country in search of food. So far as known, such 'lemming migrations' and 'vole plagues' are phenomena peculiar to the Old World.[1]

NOMENCLATURE.

Before considering the characters of the genera and subgenera of *Microtinæ* it is necessary to examine a considerable part of the mass of technical literature to which, during the past hundred and forty years, the animals in question have given rise. Since Linnæus published the tenth edition of the Systema Naturæ more than fifty names have been used for the less than two dozen namable superspecific groups recognizable in the subfamily. In considering their claims to recognition the names may be best taken up chronologically.

Mus Linnæus, 1758 (Syst. Nat., Ed. 10, p. 59), contained the following species: *Porcellus*, *leporinus*, *lemmus*, *marmota*, *monax*, *cricetus*, *terrestris*, *amphibius*, *rattus*, *musculus*, *avellanarius*, *sylvaticus*, *striatus*, *longipes*, *jaculus*, *volans*. Since two[2] of these (*lemmus* and *terrestris*) are

---

[1] An account of the migrations of *Lemmus lemmus* in Norway is given by Prof. R. Collett in Christiania Videnskabs-Selskabs Forhandlinger, 1895, No. 3.

For description of a vole plague in Scotland, see Report of the Departmental Committee appointed by the Board of Agriculture to inquire into a Plague of Field Voles in Scotland. London, 1893.

[2] Apparently three, but *terrestris* and *amphibius* are, as Lataste has already shown, the same animal. The *Mus amphibius* of Linnæus is nothing more than a figment of the imagination based on Ray's misconception that there is a large aquatic vole with webbed feet.

Since the matter is of importance as determining the validity of the current name of one of the most common European mammals, I quote Linnæus's descriptions in full:

"[Mus] terrestris, 7. M. cauda mediocri subpilosa, palmis subtetradactylis, plantis pentadactylis, auriculis vellere brevioribus.

"Mus cauda longissima pilosa, auribus subrotundis vellere brevioribus. Fn. svec. 29. Syst. Nat., 10, n. 5.

"Mus agrestis, capite grandi, brachiuros. Raj. quadr. 218.

"Habitat in Europæ terra et aqua.

"Corpus fuscum subtus pallidum, at non albicans. Caput crassius, ore gibbo. Cauda magis pilosa, quam in Ratto, sed corpore dimido brevior, a pedibus fere longior.

"Hortos Talpæ instar misere effodit palmis licet parvis; natat in fossis et urinatur plantis licet fissis; Radices arborum decorticat, plantarum consumit s. aufert; Pullos anatum in piscinis occidit.

"[Mus] amphibius, 8. M. cauda elongata pilosa, plantis palmatis.

"Mus major aquaticus s. Rattus aquaticus. Raj. quadr. 217.

"Mus aquaticus. Bell. aquat. 35. t. 36.

Microtines, it is necessary to see whether the name can be applied to any genus of the subfamily. Linnæus of course designated no type, but subsequent usage has fixed the name on the congeners of *Mus musculus*. As no sound principle of nomenclature is thus violated, the name *Mus* should be kept in its present signification.

Castor Linnæus, 1758 (Syst. Nat., Ed. 10, p. 58), was originally proposed for the species *fiber* and *moschatus*, but in the twelfth edition of the Systema others were included, among them the muskrat. The name, however, could by no process of subsequent elimination be applied to the latter.

Glis Brisson, 1762 (Regn. Anim., pp. 13, 113), is clearly based on the dormice,[1] although the genus includes 'la Marmotte de Bahama,' 'la Marmotte d'Amerique,' 'la Marmotte de Pologne,' 'la Marmotte des Alpes,' and 'la Marmotte de Strassbourg,' in addition to 'le Loir,' 'le Lerot,' and 'le Croquenoix.' The name must, therefore, take the place of *Myoxus* Schreber, 1781, commonly used for the dormice.[2] As none of the species of Brisson's *Glis* are Microtines, the name would not be mentioned here were it not for its bearing on *Glis* Erxleben, 1777.[3] (See p. 13.)

Cuniculus Brisson, 1762 (Regn. Anim., p. 13), must also be considered, because it invalidates the use of *Cuniculus* Wagler as the generic name of a lemming (see page 16).[4] The genus contained an assemblage of forms which are now put in six genera distributed among five families. Dr. C. Hart Merriam has recently shown (Science, n. s., I, p.

[Continuation of note from page 11.]

"Habitat in Europæ, Africæ fossis, ripis, piscinis, hortis.

"Species mihi non rite cognita.

"Fodit ad fossas et radicis arborum, natat, urinatur, consumit radices, Hortis et satis infestus, capitur Nassis e virgulis confectis sub aqua demersis."

The description of *Mus terrestris* is extended and applies to the water rat in every particular, while the diagnosis of *M. amphibius* is very brief and contains a glaring error in the assertion that the animal has webbed feet. That the common water rat was the animal which Linnæus had in mind when he described *Mus terrestris* is shown by the length and accuracy of the description and by his choice of the specific name (*Mus terrestris* is the Latin equivalent of the Swedish jordråtta). That he never saw '*Mus amphibius*' is clearly indicated by the statement: "Species mihi non rite cognita." It is thus evident that there is no excuse for retaining the specific name *amphibius*, even though the error through which it is now generally used has passed current for nearly a century.

[1] In the Tabula Synoptica Quadrupedum secundum Ordines Sectiones et Genera, on pages 12 and 13, the name is introduced as follows:

Cauda longa, vestita pilis ita dispositis at caudum planum efficiant .... *Sciurus*
Cauda longa, vestita pilis ita dispositis at caudum rotundam efficiant .... *Glis*

[2] See Merriam, Science, n. s., I, p. 376, April 5, 1895.

[3] *Glis* Brisson also antedates *Glis* Storr (Prodr. Meth. Mamm. 1780, p. 39), proposed for *Mus tamaricinus*, *M. longipes*, *M. cafer*, *M. sagitta*, *M. jaculus*, *M. nitidula*, *M. avellanarius*, and *M. glis*.

[4] In the synoptic table (pp. 12, 13) the name is introduced as follows:

Cauda brevissima vel nulla:
Auriculis longis .... *Lepus*
Auriculis brevibus vel nullis .... *Cuniculus*

376, 1895) that by elimination *Cuniculus cauda longissima* Brisson (=*Dipus alactaga* Olivier) becomes the type. The name is thus untenable for any of the *Muridæ*, although *Lemmus lemmus* is one of the species included by Brisson in the genus.

Glis Erxleben, 1777 (Syst. Regn. Anim., p. 358), contained *marmota*, *monax*, *canadensis*, *tscherkessicus*, *zemnii*, *lemmus*, *migratorius*, *barabensis*, *arenarius*, *lagurus*, and *œconomicus* [=*Mus songarus* Pall.]. Although this genus contains two lemmings, the name need not be considered, since it is preoccupied by *Glis* Brisson, 1762.

Arctomys[1] Schreber, 1780 (Plates to Schreber's Säugth., CCVII–CCIX, 1780), contained the following species: *marmota*, *monax*, *bobac*, *empetra*, and *citillus*. Of these the first four belong to the genus *Arctomys* as now understood, and the last to *Spermophilus*. The latter genus was defined in 1823 by F. Cuvier (Dents des Mammifères, 1823, 160–162, 255), who restricted the name *Arctomys* to the group to which it is now applied. *Arctomys* Schreber is mentioned here only on account of:

Lagomys Storr, 1780 (Prodromus Methodi Mammalium, p. 39). Although Storr and Schreber bear the same apparent date, it appears safe to take Schreber as the earlier, since Storr alludes to the genus *Arctomys*, and refers directly to the '*Mus glareolus* Schreberi,' a species published at the same time.[2] Storr evidently proposed *Lagomys* merely as a substitute for *Arctomys*, a name which he considered inappropriate, because the animals to which it was applied resemble hares rather than bears.[3] It is thus a synonym of *Arctomys* and requires no further consideration.[4]

Myocastor Kerr, 1792 (Animal Kingdom, I, Mamm., Syst. Cat. Nos. 458–521), included the coypu and muskrat. No type was designated, but subsequent elimination fixed the name on the coypu. (See p. 14.)

Ondatra Link, 1795, (Zool. Beyträge, Vol. I, Pt. II, p. 76), contained the same species as *Myocastor* Kerr, of which the name is thus a synonym.

Lemmus Link, 1795 (Zool. Beyträge, Vol. I, Pt. II, p. 75), has escaped the notice of recent writers. Vague references to it occur in works of the early part of the present century, but of late all traces have disappeared. Lataste (Le Naturaliste, Tome II, p. 473, 1882), after a long and fruitless search, concluded that the name had probably never been published, and that the references of the older authors were merely to Link's manuscript. Mr. Oldfield Thomas has discovered Link's book and finds that the genus *Lemmus* contained the species *socialis*, *lagurus*, *lemmus*, *torquatus*, *glareolus*, and *hudsonius*,[1] representing the modern genera *Lemmus*, *Dicrostonyx*, *Microtus*, and *Evotomys*. As the name *Lemmus* has been restricted by subsequent authors to the species *lemmus* and its near allies, a group to which no other generic name has been specially applied, it must be retained in this sense.[2]

---

[1] This name is apparently antedated by *Marmota* Blumenbach ("Handb. d. Naturgesch., 1779," fide Agassiz). I have been unable to verify the reference, and do not know what species were included by Blumenbach in the genus.

[2] On the dates of the parts of Schreber's Säugthiere, see Sherborn, Proc. Zool. Soc., London, 1891, 587.

[3] "Sequuntur in eundem finem nomina specierum, laudato Pallas pariter ad mures tractarum, quae mihi genus constituerunt, Lagomys, nec Arctomys dictum, nam Lepori aptius quam Urso, comparari posse videantur. Dicendæ species nominibus Ill. Pallas æque adhibitis, hæc sunt; *M. arenarius*, *M. songarus*, *M. furunculus*, *M. cricetus*, *M. accedula*, *M. phæus*, *M. lagurus*, *M. gregalis*, *M. socialis*, *M. œconomus*, *M. rutilus*, *M. glareolus* Schreberi, *M. monax*, *M. marmota*, *M. empetra*, *M. arctomys*, *M. citillus*, *M. lemmus*, *M. torquatus*, *M. hudsonius*, *M. talpinus*, *M. capensis*, *M. aspalax*, *M. typclus*" (sic.).

[4] *Lagomys* Storr of course antedates *Lagomys* Cuvier, 1800, the current name for the pikas.

Microtus Schrank, 1798 (Fauna Boica, p. 72), included *M. terrestris*, *M. amphibius* (=*M. terrestris* Linn.), and *M.* '*gregarius*.' The *Microtus terrestris* of Schrank is not the *Mus terrestris* of Linnæus, but the common field mouse of Central Europe, *Microtus arvalis* (Pallas). *M. gregarius* Schrank, apparently based on one specimen from Bettbrunn, is probably a young *M. arvalis*. The third species, *M. amphibius*, is the water rat, *Microtus terrestris* (Linnæus). Thus the genus *Microtus* originally contained two species, *arvalis* and *terrestris*. As the latter was made the type of *Arvicola* by Lacépède in 1801, *arvalis* must be taken as the type of *Microtus*.

Fiber Cuvier, described in 1798 but not named until 1800 (Tabl. Élém. de l'Hist. Nat. d. Anim, 141, 1798; Leçons d'Anat. Comp. I, Tabl. I, 1800), is the first and only generic name based exclusively on the muskrat. Cuvier, in establishing this genus, eliminated *Fiber zibethicus* from *Myocastor*, and thus fixed the latter name on *M. coypu*. (See page 13.)

Arvicola Lacépède, 1801 (Mém. de l'Inst., III., Paris, 1801, 489[3]), was based on *Arvicola amphibius* (=*Mus terrestris* Linn.) alone, and not on the European voles in general, as often supposed.[4] Although the name *Arvicola* can not be used in a generic sense, it is available for the subgenus of which *Microtus terrestris* is the type.

Hypudæus Illiger, 1811 (Prodr. Syst. Mamm. et Avium, p. 87), contained the species *lemmus*, *amphibius* (=*terrestris*), and *arvalis*, or the modern genera *Lemmus* and *Microtus*. As no type was designated, and as both *Lemmus* and *Microtus* were included in the then undivided genus *Lemmus* Link, the name *Hypudæus* must lapse into synonymy.

---

[1] Mr. Thomas has kindly sent me a copy of the original diagnosis. It is as follows: "Gen. 8 *Lemmus*, Lemming. Die Thiere dieses Geschlechts kommen mit den vorigen [*Mus*] sehr ueberein, aber die Ohren sind viel kleiner und abgerundet, der Körper gedrungener, die Beine verhältnissmässig kürzer, der Schwanz sehr kurz. Auch weichen sie in der Lebensart von den vorigen ab. Sie nähern sich Arctomys. Hieher gehören: *Mus socialis, lagurus, lemmus, torquatus, glareolus, hudsonius.*"

[2] See note on the names *Brachyurus*, *Myodes*, *Hypudæus*, and *Lemmus*, in Actes de la Société Scientifique du Chili, Tome V, pp. XX, XXI, 1895.

[3] This is sometimes quoted: "Tableau des divisions, etc., de la class des mammifères, 1799." The paper was "lu le 21 prairial an. 7," though not published until 1801.

[4] Lacépède's description is as follows: "44 Campagnol. Deux incisives supérieurs non comprimées; deux incisives inférieurs tranchantes; molaires sillonnées; point d'abajoues; queue velue. Campagnol aquatique—Arvicola amphibius."

Myodes Pallas, 1811 (Zoog. Rosso -As., I. p, 172), embraced ten species, now placed in four genera. The species are: *Lemmus, torquatus, lagurus, œconomus, arvalis, saxatilis, gregalis, socialis, alliarius*, and *rutilus;* the genera: *Lemmus* (*lemmus*), *Dicrostonyx* (*torquatus*). *Microtus* (*œconomus, arvalis, saxatilis, gregalis, socialis, alliarius, lagurus*), and *Evotomys* (*rutilus*). Since *Myodes* contained species of exactly the same modern genera as *Lemmus* Link and no groups not included in the latter, the name is a synonym of *Lemmus*.

Brachyurus Fischer, 1813 (Zoognosia, I, 3d ed , pp. 14, 24: III, 1814, p. 55), contained the species: *arvalis, rutilus, amphibius, lemmus, torquatus, alliarius, blumenbachii, fulvus* Geoffroy, *niloticus* Geoffroy: also the 'species dubiæ': *zemni, gregarius, socialis, lagurus, œconomus*. The name is a pure synonym of *Lemmus* Link, unless it may be applied to some of the exotic or dubious species.[1]

Alviceola Blainville, 1817 (Nouv. Dict. d'Hist. Nat.. IX, p. 287), proposed for 'le Genre Campagnol' is probably an erratic misprint for *Arvicola*. No type is mentioned.

Mynomes Rafinesque, 1817 (American Monthly Magazine, II, p. 45), was based on Wilson's figure of the common meadow mouse of the eastern United States. The name is thus a synonym of *Microtus* Schrank, as *Microtus arvalis* and *M. pennsylvanicus* can not be separated subgenerically.

Psammomys LeConte, 1830 (Ann. Lyc. Nat. Hist., N. Y., III, p. 132), is the first name proposed for the subgenus containing *Microtus pinetorum*. It is, however, preoccupied by *Psammomys* Cretzschmar, 1828 (Atlas zu der Reise im Nördl. Afrika. 1ste Abth., Zool. (1826), Heft XI, 1828, p. 56. Type *Psammomys obesus* Cretzschmar) and so can not be used here. The date of *Psammomys* LeConte is usually quoted as 1829, but the paper on this genus, although read on December 21, 1829, was probably not published until after the end of January, 1830, since papers read January 11–25, 1830, are included with it in one signature.

Pitymys McMurtrie and *Ammomys* Bonaparte both appeared in 1831. McMurtrie (American ed. Cuvier's Règne Animal, I, p. 434) pointed out that *Psammomys* LeConte is preoccupied, and for this name substituted *Pitymys*. Bonaparte (Saggio Distrib. Metod. degli Anim. Vert., p. 20, footnote) after showing that LeConte's name *Psammomys* is not tenable, proposed to change it to *Ammomys*, thus preserving the original meaning of the word.[2] It is impossible to tell which name is the earlier, but in the uncertainty *Pitymys* should be retained as the one adopted by all subsequent writers.

---

[1] This name has been supposed to be preoccupied by *Brachyurus* Spix (Lataste, Ann. Mus. Civ. St. Nat. di Genova, XX, p. 264; Büchner, Wissensch. Result. der von N. M. Przewalski unternomm. Reisen, I, p. 127). Spix's name, however, dates from 1823 and would in no way invalidate *Brachyurus* Fischer, were the latter on other grounds tenable.

[2] "Prendiamo la libertà d' introdurre una piccola mutazione ortografica nel nome dato al nuovo genere dal Sig. LeConte, la quale non ne cambia però il significato."

Cuniculus Wagler, 1830 (Nat. Syst. d. Amphibien, p. ~~3~~21), included three species (*C. lemmus*, *C. torquatus*, and *C. aspalax*) now referred to three genera and two subfamilies. The name has been commonly applied to *torquatus* and its congeners, but its use is invalidated by *Cuniculus* Brisson, published fifty-eight years before.

Hemiotomys DeSélys-Longchamps, 1836 (Essai monograph. sur les Campagnols des environs de Liège, p. 7), was proposed as a section of *Arvicola* (=*Microtus*) to include the species *fulvus* (=*arvalis*) and *amphibius* (=*terrestris*). As each of these had already received a tenable subgeneric name, *Hemiotomys* lapses into synonymy.

Pinemys Lesson, 1836 (Hist. Nat. d. Mamm. et Ois. découv. depuis 1788, Compl. Œuvres de Buffon, V, p. 436), based on *Psammomys pinetorum* LeConte, is a synonym of *Pitymys* McMurtrie.

Lagurus Gloger, 1841 (Gemeinnütz. Hand- u. Hilfsbuch d. Naturgeschichte, I, pp. XXXI, 97), is the earliest available name for the subgenus of which *Mus lagurus* Pallas is the type.[1] (See footnote, p. 49.)

Dicrostonyx Gloger, 1841 (l. c., pp. XXXI, 97), is the tenable name for the genus usually known as *Cuniculus* Wagler.[2] This name has escaped notice until very recently.[3]

Neodon Hodgson, 1849 (Ann. & Mag. Nat. Hist., 2d ser., III, p. 203), is a synonym of *Microtus*, as its type, *N. sikkimensis* Hodgson, can not be separated subgenerically from *Microtus arvalis*.

"*Myolemmus* Pomel, 1854 (Ann. Sci. Soc. Auvergne)," is a synonym of *Dicrostonyx* Gloger. This statement is made on the authority of Trouessart (Cat. Mamm. viv. et foss., Rodentia, Pt. II, p. 156, 1881), as I have had no opportunity to verify the reference.

Misothermus Hensel, 1855 (Zeitschr. der Deutsch. geolog. Gesellsch., VII, p. 492), is stated by the author to be based on *Myodes torquatus* Pall. It is thus antedated by *Myolemmus* Pomel and *Dicrostonyx* Gloger.

Pedomys, *Chilotus*, and *Synaptomys* are three names proposed by Baird in 1857 (Mamm. N. Am., pp. 516, 517, 558). All are tenable for the groups to which they were applied. *Pedomys* and *Chilotus* are subgenera of *Microtus*. Their types are *Microtus austerus* and *M. oregonus*, respectively. *Synaptomys* is a genus, with *S. cooperi* as the type.

---

[1] Gloger's description is as follows: "Theils auf dem Ural und anderen Gebirgen, theils auch in tieferen Gegenden Sibiriens, giebt es, drei oder vier andere Arten mit kleinen, rundlichen oder spitzigen Daumnägeln und von einfacherer Färbung (*Lagurus*), die zum Theile nicht weniger zum Wandern geneigt scheinen. Z. B. *L. migratorius*."

[2] Gloger says: "Von den nordamerikanischen Lemmingen zeichnen sich manche durch ein Paar höchst sonderbare (gleichsam doppelte) Vorderkrallen aus, die 2 oder gar 3 Spitzen über einander zu haben scheinen, weil sie unter den Nägeln grosse, harte Ballenhervorragungen besitzen. Sie können daher Gabelkraller (Dicrostonyx) heissen."

[3] For a paper on Gloger's generic names for mammals, see Thomas, Ann. & Mag. Nat. Hist., 6th ser., XV, Feb. 1, 1895.

Paludicola Blasius, 1857 (Fauna der Wirbelth. Deutschl., Bd. I, Säugethiere, p. 333), a subgenus of *Arvicola* (=*Microtus*), contained the species: *amphibius* (=*terrestris*), *nivalis*, and *ratticeps*. As the first is a member of the subgenus *Arvicola* and the others each a true *Microtus*, the name can not be used. Moreover, it is preoccupied by *Paludicola* Wagler, 1830 (Nat. Syst. d. Amphibien, p. 206, type *Bufo albifrons* Spix).

Agricola Blasius, 1857 (l. c., p. 334), was proposed as a subgeneric name for *Microtus agrestis*. The differences between this species and the allies of *M. arvalis* are too slight to entitle the groups to rank as distinct subgenera; but assuming that it were desirable to separate them the name *Agricola* would be antedated by *Mynomes* Rafinesque, 1817, based on *Microtus pennsylvanicus*, a form whose superspecific characters are exactly similar to those of *M. agrestis*.

Phaiomys Blyth, 1863 (Journ. Asiat. Soc. Bengal, XXXII, p. 89), is the first and only tenable name proposed for the subgenus having *Microtus blythi* as the type.

Ochetomys Fitzinger, 1867 (Sitzungsb. K. Akad. Wiss. Wien, LVI, June, 1867, p. 47), included the water rats of Europe. It is thus equivalent to *Arvicola* Lacépède.

Praticola Fatio, 1867 (Les Campagnols du Bassin du Léman, p. 36), is a subgenus of *Arvicola* (=*Microtus*) containing: *amphibius* (=*terrestris*), *nivalis*, *arvalis*, *ratticeps*, and *campestris* (=*arvalis?*). As all of these are species either of *Microtus* Schrank, or *Arvicola* Lacépède, the name *Praticola* can not stand. *Praticola* is, moreover, preoccupied in ornithology.

Sylvicola Fatio, 1867 (l. c., p. 63), based on *Microtus agrestis* is exactly equivalent to *Agricola* Blasius, 1857. The name is preoccupied in ornithology, entomology, and conchology.

Terricola Fatio, 1867 (l. c., p. 73), contained *Microtus subterraneus* and *M. savii*. The name is, however, preoccupied in conchology by *Terricola* Fleming, 1828.

Isodelta and *Anaptogonia* Cope, 1873 (Proc. Am. Philos. Soc., XII, p. 87), are the tenable names for two extinct subgenera found in the Post-pliocene cave deposits of Pennsylvania. Their types are *Microtus speothen* and *M. hiatidens*, respectively.

Evotomys Coues, 1874 (Proc. Acad. Nat. Sci. Phila., p. 186), is the tenable name for the genus of which *Mus rutilus* is the type.

Micrurus Forsyth Major, 1876 (Atti della Società Toscana di Sci. Naturali, III, fasc. I, p. 126), founded on Mina Palumbo's description of *Arvicola nebrodensis* (a *Pitymys*), is preoccupied by *Micrura* Ehrenberg, 1831, a genus of Vermes.

Alticola Blanford, 1881 (Journ. Asiat. Soc. Bengal, L, pt. 2, p. 93), is the only name proposed for the Asiatic subgenus with *Microtus stoliczkanus* as type.

Eremiomys and *Borioikon* Polyakoff, 1881 (Mém. Acad. Imp. Sci. St.

Petersbourg, XXXIX suppl., p. 34), based, respectively, on *Mus lagurus* Pallas and *Mus torquatus* Pallas, are synonyms of *Lagurus* Gloger and *Dicrostonyx* Gloger.

Neofiber True, 1884 (Science, IV, p. 34), was described as a genus with *N. alleni*, the only known species, as type. Recently it has been shown that the characters of the animal are not enough to separate it generically from *Microtus*, of which, however, *Neofiber* forms a well-marked subgenus.[1]

Lasiopodomys Lataste, 1887 (Annali del Mus. Civ. di Storia Naturale di Genova, ser. 2a, Vol. IV, p. 268), is a synonym of *Phaiomys* Blyth, 1863, the species on which the two names were based, *Microtus brandti* Radde and *Microtus blythi* Blanford (=*M. leucurus* Blyth nec *Arvicola leucurus* Gerbe), respectively, being in no way separable subgenerically.[2]

Phenacomys Merriam, 1889 (North Am. Fauna, No. 2, p. 28), is the tenable name for the genus of which *Phenacomys intermedius* is the type.

Campicola Schulze, 1890 (Schriften Naturwiss. Vereins d. Harzes in Wernigerode, V, p. 24), is a subgenus formed for the reception of the species *Microtus arvalis*, *M. subterraneus*, and *M. campestris*. It is thus a compound of two subgenera, *Microtus* (*arvalis* and *campestris*) and *Pitymys* (*subterraneus*), each of which has previously received a tenable name. *Campicola* is, moreover, preoccupied in ornithology (Swainson, 1827).

Bramus Pomel, 1892 (Comptes Rendus, Paris, CXIV, p. 1159), is based on a mandible and the teeth of both jaws of a rodent from the Quaternary phosphorites of Trara de Nédroma near Ain-Mefta, Tunis. Although the author compares this fossil with the bones and teeth of the water rat, he points out such striking differences between the two that it is very doubtful whether *Bramus* can be considered a member of the subfamily *Microtinæ*. (See p. 73.)

Aulacomys Rhoads, 1894 (American Naturalist, XXVIII, p. 182), although based on an abnormal specimen, is the tenable name for a group of American water rats, should the latter be considered subgenerically distinct from *Arvicola*. The peculiarities of the original specimen of *Microtus arvicoloides*, the type of *Aulacomys*, are such that the group was originally given full generic rank.

Mictomys True, 1894 (Proc. U. S. Nat. Museum, XVII, No. 999, p. 242, Advance Sheet, April 26), was proposed as a full genus with *Mictomys innuitus* True for the type and only known species. The name is tenable, but the group is only a subgenus of *Synaptomys*.[3]

Tetramerodon Rhoads, 1894 (Proc. Acad. Nat. Sci. Phila., p. 282), is the most recent synonym of *Microtus*. The author, as Blasius had already done nearly forty years before, divides the subgenus *Arvicola* (= *Microtus*) into two groups, based on the structure of the middle upper molar. To the species with this tooth formed of five prisms he restricts the name *Mynomes*, while to those with the same tooth made up of only four prisms he applies the new name *Tetramerodon*. The character in question is far too trivial to serve alone as the basis for a subgenus. If, however, the advisability of subdividing the genus along such narrow lines be admitted, the name *Tetramerodon* still becomes a synonym of *Microtus*, since *M. arvalis*, the type of the latter, is itself a species with the middle upper molar four parted.

---

[1] True, Report of the Smithsonian Institution for 1884, Part II, pp. 325–330, Pl. II. Merriam, North American Fauna, No. 5, p. 60, 1890. Chapman, Bull. Am. Mus. Nat. Hist., New York, VI, p. 334, 1894.

[2] See Actes de la Société Scientifique du Chili, IV, p. CLXXXVIII, 1894.

[3] See Merriam, Proc. Biol. Soc. Washington, X, p. 57, 1896.

HISTORY OF FORMER CLASSIFICATIONS.

The most important studies of the various groups of *Microtinæ*, but more especially of the subgenera of *Microtus*, are those of De Sélys Longchamps (1836 to 1862), Blasius (1857), Baird (1857), Fatio (1867), Coues (1874), Blanford (1881), and Lataste (1887). The names used by these authors for the subdivisions of *Microtus* adopted in the present classification are shown in the accompanying table:

Table of Names used by Authors for the Subgenera of Microtus.

Names used in the present paper.	De Sélys Longchamps, 1836 to 1862.	Blasius, 1857.	Baird, 1857.	Fatio, 1867.	Coues, 1874.	Blanford, 1881.	Lataste, 1887.
Arvicola	*Hemiotomys*	*Paludicola*	....	*Praticola* (part).	....	....	*Arvicola*.
Microtus	*Arvicola* ... *Mynomes* ..	*Arvicola* (part). *Agricola* ..	.... *Hemiotomys*.	*Praticola* (part). *Sylvicola* ..	.... *Myonomes*	.... *Neodon*, (part).	*Microtus*.
Pitymys	*Microtus*	*Arvicola* (part).	*Pitymys* ..	*Terricola* ..	*Pitymys* ..	....	*Pitymys*.
Pedomys	....	....	*Pedomys* ..	....	*Pedomys* ..	....	
Phaiomys	....	....	....	....	....	*Paludicola*	*Lasiopodomys*.
Chilotus	....	....	*Chilotus* ..	....	*Chilotus* ..	....	
Lagurus	....	....	....	....	....	....	
Alticola	....	....	....	....	....	*Alticola* ...	
Hyperacrius .	....	....	....	....	....	*Alticola* part ?.	
Eothenomys ..	....	....	....	....	....	*Neodon* (part).	
Anteliomys ..	....	....	....	....	....	....	
Neofiber	....	....	....	....	....	....	

De Sélys Longchamps published two extended papers on the European *Microtinæ*, and later a note supplementary to the first of these. The first paper appeared in 1836 under the title 'Essai Monographique sur les Campagnols des environs de Liège.' In this the author showed that hitherto the voles had been divided into two groups, according to their habits, the aquatic species being separated from those that are strictly terrestial. This proved unsatisfactory because the two were found to intergrade imperceptibly. Hence he proposed to rearrange the species according to the length of the ears. The first division, or that in which the ears are extremely short or apparently absent, he named *Hemiotomys.* This the author subdivided into two sections, neither of which he named. The first contained one species, *Arvicola fulvus* (=*Microtus arvalis*), distinguished by its short tail and by the supposed absence of external ears. The second contained the water rat. To *Arvicola* (=*Microtus*) proper were referred the three species, *arvalis*, *subterraneus*, and *rufescens* (=*Evotomys glareolus*). Six years later, in his Études de Micromammalogie, De Sélys Longchamps followed the same system of classification, but considerably extended it and included species from Asia and North America. This later scheme is as follows:

The genus is first divided into two sections, one of which consists of species with ears shorter than the fur and with very small eyes, the other of species with the ears as long as the fur and with the eyes well developed. The first section contains two groups, (1) *Hemiotomys* with the European water rats and the American *Arvicola riparius* (=*Microtus pennsylvanicus*), and (2) *Microtus* with the species *fulvus*, *savii*, *œconomus*, and certain American forms not mentioned by name. The second section is divided into three groups: (1) *Arvicola* with the species *subterraneus*, *arvalis*, *gregalis*, *alliarius*, *duodecimcostatus*, and *socialis;* (2) *Myodes* with the two species *rubidus* (=*Evotomys glareolus*) and *rutilus* (=*Evotomys rutilus*); (3) *Mynomes* with the species *pratensis* (=*Microtus pennsylvanicus*). These groups and sections the author considers in no way entitled to rank as genera or subgenera. He names them merely for convenience.[1] In a postscript published at the time of distribution of the last copies of the Essai Monographique, twenty-six years after its appearance, the author makes a few corrections in the classification previously adopted. He points out that his *Arvicola fulvus* is merely a young specimen of *A. arvalis* that by accident had lost its external ears, and, furthermore, that the species *subterraneus* should be transferred to the section *Microtus.*

The classification as finally perfected is as follows:

Genus *Arvicola:*
  Group *Hemiotomys* (water rats).
  Group *Microtus* (*subterraneus* and *savii*).
  Group *Arvicola* (typical voles).
  Group *Myodes* (*glareolus*).
  Group *Mynomes* (*pennsylvanicus*).

---

[1] Je dois prévenir que je m'opposerais entièrement à l'élévation d'aucune de ces sections au rang de genre ou de sous-genre. Toutes passent de l'une à l'autre par des nuances insensibles dans la longueur de la queue et des oreilles; et, quant au caractère tiré de la racine des dents, il est probable qu'il existe à un degré plus ou moins fort chez d'autres espèces. Si je me suis permis d'imposer à ces groupes des noms latins pris parmi les synonymes du genre, ce n'est nullement pour qu'ils puissent être introduits dans la nomenclature binaire, mais pour donner aux étrangers l'idée des divers noms que j'ai employés en français. (Micromammalogie, p. 87.)

The groups *Hemiotomys*, *Microtus*, and *Arvicola* of De Sélys Longchamps are exactly equivalent respectively to the subgenera *Arvicola*, *Pitymys*, and *Microtus* of the present paper, while *Myodes* is the same as the genus *Evotomys*. The group *Mynomes* based on Rafinesque's description of *Mynomes pratensis* (=*Microtus pennsylvanicus*) should be united with *Arvicola* (*Microtus*, as now understood), a course which the author no doubt would have followed had he been acquainted with the type species.

Blasius published in 1857, in his 'Fauna der Wirbelthiere Deutschlands,' a classification of the voles based primarily on the pattern of enamel folding in the first and second molars of the lower jaw and the second molar of the upper jaw. This system differs in many ways from that of De Sélys Longchamps, and is as follows:

- Genus *Arvicola:*
  - Subgenus *Hypudæus* (*glareolus*).
  - Subgenus *Paludicola* (*amphibius* [=*terrestris*], *nivalis*, *ratticeps*)
  - Subgenus *Agricola* (*agrestis*).
  - Subgenus *Arvicola:*
    - *A. Arvicola* (*campestris*, *arvalis*).
    - *B. Microtus* De Sélys part (*subterraneus*, *savii*).

The subgenus *Arvicola* Blasius subdivides into two sections, A. *Arvicola* and B. *Microtus* De Sélys (part). The former includes the species *campestris* and *arvalis*, the latter *subterraneus* and *savii*. The subgenus *Hypudæus* and the section *Microtus* are equivalent, respectively, to the genus *Evotomys* and the subgenus *Pitymys* of the present paper. Of the other groups, the restricted *Arvicola* contains the typical species of the subgenus *Microtus*, *Agricola*, a slightly aberrant form of the same, and *Paludicola*, the subgenus *Arvicola* and two aberrant members of the subgenus *Microtus*. Blasius's subgenera *Paludicola* and *Arvicola* are excellent illustrations of the unnatural results of a system of classification based on one set of characters. While there is a general similarity between the enamel pattern of the three species associated in the former, *Microtus terrestris* differs from *M. ratticeps* and *M. nivalis* in the form of the skull, the number of plantar tubercles, the quality of the fur, and in the presence of large musk glands on the sides. In the subgenus *Arvicola* Blasius associates two of the most distinct subgenera of the genus *Microtus* (*Microtus* and *Pitymys*), and treats the differences in the number of mammæ and footpads, form of skull, and size of eyes as matters of trifling importance in comparison with the general similarity of the enamel pattern. On the other hand, the author recognizes *Agricola* as a full subgenus, when the chief character on which the group is based is the presence of a minute supplemental postero-internal prism on the middle upper molar.

The classification adopted by Baird (Mamm. N. Am., 1857) is based on a combination of characters, and is thus much more satisfactory than the artificial arrangement published almost simultaneously by

Blasius. His classification of the subdivisions of *Microtus* is as follows:

- Genus *Arvicola:*
  - Subgenus *Hypudæus* (*gapperi*).
  - Subgenus *Arvicola* (typical voles).
    - Section *Hemiotomys* (most of the American species and the European *agrestis*).
    - Section *Chilotus* (*oregoni*).
    - Section *Pedomys* (*austerus*).
    - Section *Pitymys* (*pinetorum*).

Baird's subgenera *Hypudæus* and *Arvicola* are equivalent to the genera *Evotomys* and *Microtus* of the present paper, while his sections *Chilotus*, *Pedomys*, and *Pitymys* are equal to the subgenera of the same names. The section *Hemiotomys* of Baird is the *Arvicola* of De Sélys Longchamps, and the subgenus *Microtus* of the present paper.

In 1867 Fatio published a classification of the European voles in a paper entitled 'Les Campagnols du Bassin du Léman.' This arrangement is essentially the same as that of Blasius. Fatio, however, recognizes *Hypudæus* (=*Evotomys*) as a full genus, and raises the second of Blasius's two sections of the subgenus *Arvicola* to the rank of a subgenus, while the first he unites with *Microtus terrestris*, *M. nivalis*, and *M. ratticeps* to form the subgenus *Praticola*. He also arbitrarily changes the names of certain groups. His classification is as follows:

- Genus *Hypudæus* (*glareolus*).
- Genus *Arvicola*.
  - Subgenus *Praticola* ('*amphibius*,' *nivalis, arvalis, ratticeps, campestris*).
  - Subgenus *Sylvicola* (*agrestis*).
  - Subgenus *Terricola* (*subterraneus, savii*).

The subgenus *Terricola* and the genus *Hypudæus* are equal, respectively, to the subgenus *Pitymys* and the genus *Evotomys* of the present paper. The subgenus *Sylvicola* is equivalent to the subgenus *Agricola* of Blasius, like it containing the pentamerodont species of the subgenus *Microtus*. The subgenus *Praticola* includes the type species of both *Arvicola* and *Microtus*, together with three other tetramerodont species of the latter.

In 1874 Dr. Coues published, in the Proceedings of the Academy of Natural Sciences of Philadelphia, an abstract of his monograph of the North American Muridæ, which appeared in full in Volume XI of the Report of the United States Geological Survey of the Territories (Monographs of North American Rodentia). Here he presented a classification of the American *Microtinæ* based primarily on Baird's review of the group. The differences between the arrangements adopted by Baird and Coues are so slight that a few words only are necessary in regard to the latter. Dr. Coues recognizes the red-backed mice as a distinct genus, which he calls *Evotomys*, after showing that the name *Hypudæus* generally used for the group is untenable. The subgenera of *Microtus* adopted by Dr. Coues are exactly equivalent to Baird's sections of his typical subgenus *Arvicola*. Dr. Coues points out Baird's error in the application of the name *Hemiotomys* De Sélys Longchamps, and substitutes for the latter the equally untenable *Mynomes* Rafinesque.

In 1881 Blanford proposed, in the Journal of the Asiatic Society of Bengal (Vol. L, Pt. II, pp. 88–117), a classification of the voles of the Himalayas, Tibet, and Afghanistan. The species occurring in this region he arranges in three sections, thus:[1]

Genus *Arvicola:*
    Section *Paludicola*, (*blythi, mandrianus*).
    Section *Alticola* (*stoliczkanus, stracheyi, roylei, blanfordi, wynnei*).
    Section *Neodon* (*sikkimensis, melanogaster*).

Blanford's 'sections' *Paludicola* and *Neodon* are excellent instances of unnatural classifications based on single characters. *Microtus blythi* and *M. mandrianus* are species of *Phaiomys*, a subgenus which differs from the water rats or from *Microtus* (*Microtus*) *nivalis* and *M.* (*M.*) *ratticeps* (all of which were included by Blasius in *Paludicola*) in many important characters. Because there is a general likeness in the pattern of enamel folding they are united under one superspecific name. Again, Blanford places in the section *Neodon* the species *Microtus sikkimensis*, which is a slightly abnormal member of the subgenus *Microtus*, and *Microtus melanogaster*, a species with the bony palate formed exactly as in the red-backed mice (*Evotomys*). These members of widely different groups are brought together on account of a very superficial likeness in enamel pattern. Blanford's section *Alticola* is probably equal to the subgenera *Alticola* and *Hyperacrius* of the present paper, though it is still a matter of doubt whether it actually included any members of the latter.

The most recent classification of the subgenera of *Microtus* is that proposed by Lataste. This author has published two important papers on the subject, the first in Le Naturaliste (Tome II, pp. 323, 324, 332–334, 342, 343, 347–349, 1883), and the second in the Annali del Museo Civico di Storia Naturale di Genova (Serie 2*a*, Vol. IV, pp. 259–274, 1887). While recognizing the unsatisfactory nature of the artificial classification adopted by Blasius, Lataste subdivides the voles in accordance with a system fully as arbitrary as that followed by any of his predecessors. According to Lataste the characters derived from the teeth of the voles are of no value except in distinguishing between genera.[2] The subgenera he arranges according to the number of mammæ and plantar tubercles. Although this system leads to a tolerably satisfactory arrangement of the European voles, it can not be applied to the genus at large, since it would unite such distinct groups as *Arvicola* and *Chilotus*, or *Neofiber* and *Pitymys*. Lataste's classification is as follows:

---

[1] Blanford adopted Blasius's classification of the voles at large (pp. 91, 92). Except in the case of *Paludicola*, however, he supposed that none of the European sections of the genus *Microtus* are represented in the region with which he deals.

[2] "Chez les Rongeurs du moins, sinon chez tous les Mammifères, les charactères de la denture me semblent d'ordre générique quand ils sont suffisamment nets et tranchés, mais sans aucune importance taxonomique quand ils sont aussi minimes que ceux que l'on invoque d'ordinaire, à la suite de Blasius, chez les Campagnols, et

Genus *Microtus:*[1]
  Subgenus *Myodes* (*rutilus, glareolus*).
  Subgenus *Microtus* (*gregalis, arvalis, agrestis, ratticeps, pennsylvanicus, nivalis*)·
  Subgenus *Arvicola* (*terrestris, musignani*).
  Subgenus *Pitymys* (*pinetorum subterraneus, socialis, middendorffi*).
  Subgenus *Lasiopodomys* (*brandti*).

The subgenera *Myodes* and *Lasiopodomys* are equal, respectively, to the genus *Evotomys* and the subgenus *Phaiomys* of the present paper. The subgenera *Microtus* and *Arvicola* coincide with groups here recognized under the same names, while the subgenus *Pitymys* is essentially the same as that defined on page 58. Lataste, however, includes in *Pitymys* the species *middendorffi*, which is probably not a member of that group as now understood.

CHARACTERS ON WHICH THE PRESENT CLASSIFICATION OF THE SUBGENERA OF MICROTUS IS BASED.

In the discussion of the systems of classification hitherto adopted, the impracticability of subdividing the genus *Microtus* according to the variations in any one set of characters has been shown. The highly artificial systems of Blasius and Lataste give the best examples of the unnatural results to which any such course must inevitably lead. In the present paper the classification used is based on an assemblage of characters. The more important of these, or the ones least adapted to the special needs of the different animals, and hence least likely to vary, are: Form of skull, structure of bony palate, pattern of enamel folding, number of mammæ, number of plantar tubercles, and presence or absence of musk glands on the sides. Characters of less importance, because more readily modified to fit a species to the special requirements of its environment, and hence more unstable, are: Quality of fur, hairiness of soles, length of tail, form of front feet, size of eyes, and form of external ear. It is only through careful consideration of all these that a satisfactory arrangement of the species can be obtained.

Nearly all of the characters now used have been recognized in classifications already proposed. In every case, however, they have been assigned degrees of importance different from those which they now receive. To take the three most conspicuous examples: De Sélys Longchamps arranged the voles with regard to their external form;

---

qui portent sur les extrémités mal définies et éminemment variables, soit postérieur de la dernière molaire supérieure, soit antérieur de la première molaire inférieure." (Ann. del Mus. Civ. di Genova, Ser. 2*a*, Vol. IV, p. 260 footnote.)

Compare with this the opinion expressed by Büchner. (See footnote, p. 25.)

[1] To Lataste is due the credit of recognizing the true status of the name *Microtus*.

Blasius based his classification on the pattern of enamel folding without regard to external characters, and Lataste subdivided the group according to the numbers of mammæ and plantar tubercles, disregarding everything else. The impossibility of reaching satisfactory results by any of these methods has been pointed out by Büchner, who, however, takes an equally extreme position in his reluctance in any way to subdivide the genus *Microtus.*

Büchner was first to recognize the important fact that the enamel pattern, while variable within certain limits and hence of little value taken by itself, is nevertheless of considerable systematic importance when considered in connection with other characters.[1]

In about 75 per cent of the specimens of a given species the enamel pattern conforms to a type which may be considered normal.[2] Among the abnormal specimens constituting the remainder, the variation, however, is very considerable. In the accompanying illustrations (figs. 1, 2, 3, 4, 5, and 6) are shown some of the conspicuous aberrations in the form of the teeth of *Microtus pennsylvanicus.*[3] In the descriptions which follow the normal enamel pattern is alone considered.

---

[1] After mentioning Lataste's view (see footnote, p. 23), Büchner says: "Meiner Ansicht nach liefert im Gegentheil der Bau der Backenzähne, obwohl derselbe zuweilen auch im Bereiche einer Art leicht variirt, ein vorzügliches Merkmal, welches allein genommen für die Charakteristik einer Art nicht genügt, in Verbindung aber mit den übrigen Merkmalen sehr grosse Dienste leistet und von bedeutendem systematischen Werthe ist." (Wissenschaftliche Resultate der von N. M. Przewalski nach Central-Asien unternommenen Reisen. Zool. Theil, Bd. I, Säugethiere, Lief. 3, 1889, p. 97.)

[2] Among 285 specimens of *Microtus pennsylvanicus* 71, or 24.9 per cent have the enamel pattern in some way abnormal. Of these, 26, or 9.1 per cent, have the first outer triangle in $\underline{\text{m 3}}$ communicating more or less freely with the inner triangle (fig. 3); one has the second outer triangle opening into the posterior loop (fig. 3); two have the posterior loop of very unusual shape (fig. 3); one has a second inner closed triangle in $\underline{\text{m 3}}$ (fig. 3), and 14, or 4.9 per cent, show a distinct fourth salient angle on the outer side of the same tooth. In the first lower molar 24, or 8.3 per cent, have 6 closed triangles (fig. 4), one has only 3, still another has 7 (fig. 4), while in 5, or 1.7 per cent, there are 4 (fig. 4). Of these 285 specimens $\underline{\text{m 3}}$ is abnormal in 44 cases, or 15.4 per cent, $\overline{\text{m 1}}$ in 31 cases, or 10.8 per cent. Grouping the abnormalities according to their frequency, they may be arranged as follows:

$\underline{\text{m 3}}$ has first outer triangle open in 26 cases, or 9.1 per cent.
$\overline{\text{m 1}}$ has one additional triangle in 24 cases, or 8.3 per cent.
$\underline{\text{m 3}}$ has an additional salient angle on the outer side in 14 cases, or 4 per cent.
$\overline{\text{m 1}}$ has one less triangle than usual in 5 cases, or 1.7 per cent.
$\underline{\text{m 3}}$ has the posterior loop of very unusual shape in 2 cases, or 0.7 per cent.
$\underline{\text{m 3}}$ has the second outer triangle abnormal in 1 case, or 0.35 per cent.
$\underline{\text{m 3}}$ has an additional inner triangle in 1 case, or 0.35 per cent.
$\overline{\text{m 1}}$ has two additional closed triangles in 1 case, or 0.35 per cent.
$\overline{\text{m 1}}$ has two less closed triangles than usual in 1 case, or 0.35 per cent.

[3] The drawings here reproduced are all from specimens taken in the eastern and central parts of the United States and adjoining British Provinces. They are selected from the series of about 170 belonging to the United States Department of Agriculture.

The value of the structure of the bony palate as a taxonomic character was first pointed out by Coues,[1] who, however, considered it of rather more importance than it really is. It was at first supposed that the bony palate of all the members of the genus *Microtus* differed in a constant way from those of *Evotomys*. Mr. Oldfield Thomas has, however, recently described a *Microtus* (*M. chinensis*) in which the palate structure of *Evotomys* is almost exactly reproduced; and on further study it appears that several well-marked types may be recognized among the species of the genus. These forms of palate furnish characters of considerable worth in defining many subgenera. In all, several structures remain sufficiently constant to serve as convenient landmarks. The anterior portion of the bony palate, or that formed exclusively by the premaxillaries and maxillaries, has no special interest, as it shows very trifling variations. All the characters of importance are derived from the part lying behind the maxillo-palatine suture. This suture in the typical palate, or that occurring in true *Microtus* and in the great majority of species and subgenera (fig. 7 A) forms a broad, U-shaped loop, the convexity of which is directed forward and whose apex lies about opposite the middle of the second molar. From this point the suture on each side sweeps rapidly backward and outward until, at the level of the anterior edge of the posterior molar, practically the whole width of the palate is occupied by the palatine, and the maxillaries are reduced to a narrow rim around the edges of the alveoli.

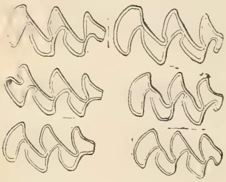


FIG. 1.—First upper molar in six specimens of *Microtus pennsylvanicus*.

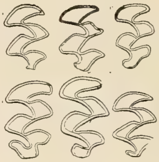


FIG. 2.—Second upper molar in six specimens of *Microtus pennsylvanicus*.

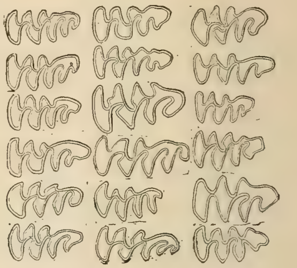


FIG. 3.—Third upper molar in eighteen specimens of *Microtus pennsylvanicus*.

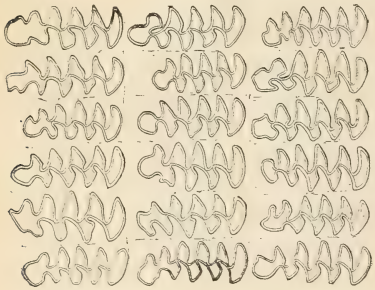


FIG. 4.—First lower molar in eighteen specimens of *Microtus pennsylvanicus*.

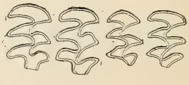


FIG. 5.—Second lower molar in four specimens of *Microtus pennsylvanicus*.

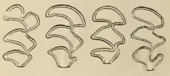


FIG. 6.—Third lower molar in four specimens of *Microtus pennsylvanicus*.

---

[1] Monogr. N. Am. Rodentia, p. 133, 1877.

Until just before acquiring its greatest width, the surface of the palatine is on the same level with the rest of the bony palate, but immediately on reaching this point it changes abruptly at the sides, more gradually in the median line, to the level of the anterior border of the interpterygoid fossa, which lies about 0.5 mm. dorsad of the main part of the bony palate. In the median line the palatine slopes gently dorsocaudad to the edge of the interpterygoid fossa, a distance usually of about 1 mm., but at the sides it breaks away suddenly, and the spaces between the median sloping ridge and maxillaries are occupied by conspicuous pits (fig. 7 A, *l. p*). The floor of each pit is continuous with the backward projection of the palatine, which runs out to join the pterygoid of its side (fig. 7 A, *pt.*). The ventral outline of the interpterygoid fossa (fig. 7 A, *i. fa.*) forms three sides of a figure, which is nearly a parallelogram, open at one end, the longer axis parallel with the main axis of the skull, and the length more than double the width. In front and for a short distance at the sides the fossa is limited by the palatines (fig. 7 A, *pl'.*), but the greater part of its boundary is formed by the pterygoids (fig. 7 A, *pt.*). The open end lies between the hamular processes of the pterygoids. Extending back from the incisive foramina are two distinct lateral grooves (fig. 7 A, *l. gr.*), which traverse the bony palate longitudinally, leaving between them a ridge which posteriorly is continuous with the sloping median ridge already described. In these grooves open numerous foramina, larger and more crowded just in front of the region from which the bony palate slopes away to

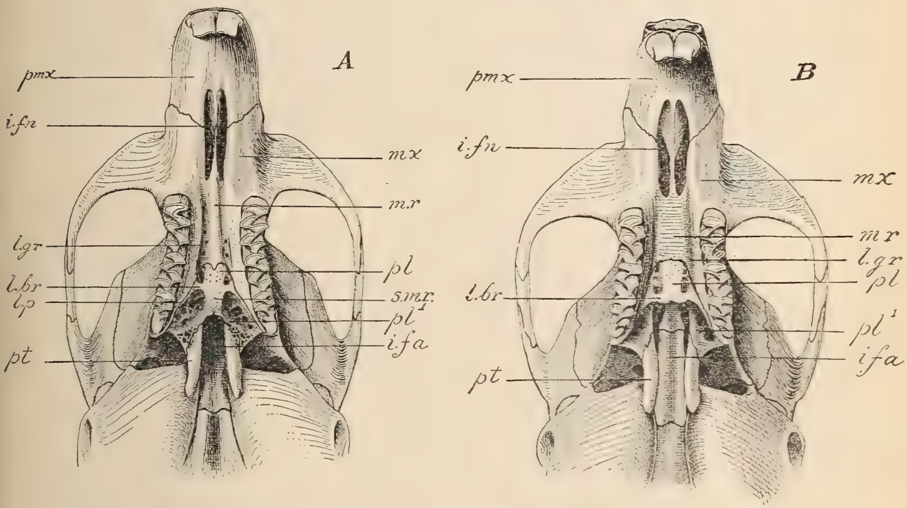


Fig. 7.—Palatal view of skull of *Microtus* (*Microtus*) *arvalis* (A) and *Evotomys gapperi* (B). (x 3). *i. fa.*, interpterygoid fossa (reference line crosses pterygoid fossa); *i. fn.*, incisive foramen; *l. br.*, lateral bridge; *l. gr.*, lateral groove; *l. p.*, lateral pit; *m. r.*, median ridge; *mx.*, maxillary; *pl.*, *pl*^{1}., palatine; *pmx.*, premaxillary; *pt.*, pterygoid (reference line crosses pterygoid fossa); *s. m. r.*, sloping portion of median ridge.

the level of the pterygoids. The median ridge just here widens abruptly and sends out on each side a short process, which is met by a similar one arising from the palatine on the opposite side of the groove (fig. 7 A, *l. br.*). These processes usually meet and fuse, thus completely obliterating the groove, though they are frequently separated by a narrow space. In *Evotomys* (fig. 7 B) the sloping part of the median ridge has disappeared, together with the lateral pits, but traces of the median ridge (fig. 7 B, *m. r.*), the lateral grooves (fig. 7 B, *l. gr.*), and the bridges (fig. 7 B, *l. br.*) may still be recognized.

At different times subgeneric weight has been given to the form of the external ear, and to the proportional length of the tail to the head and body. Neither one, however, is of any value, except in special, isolated cases. The form of the ear is essentially the same in all the subgenera, though there are slight modifications in length and in the development of the valvular fold by which the meatus is closed.

The relative length of the tail is far too variable to serve as a useful diagnostic character.

KEYS.

The following keys to the genera and subgenera of *Microtinæ* are wholly artificial and do not bring the groups together according to natural affinities. Since analytical keys are of no value except as aids in identifying specimens, it is necessary that they should be based on characters that may be studied without difficulty in ordinary museum material. Such material, however, is usually so imperfect that a single key made with reference to one set of characters (as, for instance, the form of the bony palate or the number of mammæ) might be of little use. Hence several keys are here introduced, each based primarily on a special set of structures. Of the three keys to the genera, No. 1 is made, so far as possible, with reference to the skull alone; No. 2, with reference to the teeth, and No. 3, with reference to external characters. Of the keys to the subgenera of *Microtus*, No. 5 is based primarily on characters derived from the structure of the bony palate, and is thus useless for the identification of specimens the skulls of which are not available for study. Key No. 6 is based on the pattern of enamel folding and may be used with specimens having broken skulls. The lines in italics inserted in parentheses in this key are for the identification of individuals with abnormal enamel patterns. These usually occur in the proportion of about one to four (see p. 25). Hence, one-fourth of any given lot of specimens will agree with the characters given in parentheses; the great majority, however, with those in heavy type. Key No. 7, based primarily on the mammæ and footpads, is made almost exclusively with reference to external characters. It is necessarily incomplete, since the number of mammæ and footpads is in several instances unknown. It is, of course, impossible to use this key except with alcoholic specimens or freshly killed animals. Key No. 8—if it may be called a key—is a rough grouping of the subgenera of *Microtus* according to the essential characters used in the classification here adopted. The keys are in all cases based on the characters of adults only.

1. KEY TO THE GENERA OF MICROTINÆ.

[Based primarily on the skull.]

- Skull of adult more than 50 mm. long .... *Fiber*
- Skull of adult less than 45 mm. long.
  - Molars rooted; skull always less than 30 mm. long.
    - Posterior border of palate a thin-edged shelf, continuous between alveoli of posterior molars .... *Evotomys*
    - Posterior border of palate not forming a shelf .... *Phenacomys*
  - Molars rootless; skull often more than 30 mm. long.
    - Middle part of zygoma expanded so as to form an oblique plate about 4 mm. broad .... *Lemmus*
    - Middle part of zygoma only slightly expanded.
      - Rostrum about ¼ total length of skull .... *Synaptomys*
      - Rostrum more than ¼ total length of skull.
        - Postorbital process of squamosal peg-like .... *Dicrostonyx*
        - Postorbital process of squamosal shelf-like .... *Microtus*

2. KEY TO THE GENERA OF MICROTINÆ.

[Based primarily on the teeth.]

- Length of maxillary tooth row in adult more than 14 mm. .... *Fiber*
- Length of maxillary tooth row in adult less than 13 mm.
  - Roots of lower incisors on inner (lingual) side of molar roots.
    - Upper incisors grooved .... *Synaptomys*
    - Upper incisors not grooped.
      - $\overline{\text{m 1}}$ with 3 closed triangles .... *Lemmus*
      - $\overline{\text{m 1}}$ with 7 closed triangles .... *Dicrostonyx*
  - Roots of lower incisors on outer side of molar roots.
    - Molars rooted.
      - Teeth weak; triangles tending to remain open; salient angles rounded .... *Evotomys*
      - Teeth strong; triangles closed; salient angles sharp .... *Phenacomys*
    - Molars rootless .... *Microtus*

3. KEY TO THE GENERA OF MICROTINÆ.

[Based primarily on external characters.]

- Tail flattened laterally .... *Fiber*
- Tail terete.
  - Tail shorter than hind foot.
    - Thumb with strap-shaped nail .... *Lemmus*
    - Thumb without strap-shaped nail.
      - External ear rudimentary .... *Dicrostonyx*
      - External ear well developed .... *Microtus* (Asiatic species of subgenus *Lagurus*)
  - Tail longer than hind foot.
    - Upper incisors grooved .... *Synaptomys*
    - Upper incisors not grooved.
      - Color usually reddish; molars weak, with triangles tending to remain open and with salient angles rounded .... *Evotomys*
      - Color brownish, grayish, or yellowish; very seldom reddish; molars strong, with closed triangles and sharp salient angles.
        - Molars rooted .... *Phenacomys*
        - Molars rootless .... *Microtus*

4. KEY TO SUBGENERA OF SYNAPTOMYS.

- Mandibular molars with closed triangles on outer side .... *Synaptomys*
- Mandibular molars without closed triangles on outer side .... *Mictomys*

5. KEY TO THE SUBGENERA OF MICROTUS.

[Based primarily on the bony palate.]

- Palate normal or nearly so (see p. 27).
  - Third lower molar with all triangles closed .... *Lagurus*
  - Third lower molar normally without closed triangles.
    - Claws small, those on front feet always shortest.
      - Plantar tubercles 6 .... *Microtus*
      - Plantar tubercles 5.
        - Tail more than 30 per cent of total length .... *Arvicola*
        - Tail less than 30 per cent of total length.
          - $\overline{\text{m 1}}$ with 5 closed triangles .... *Chilotus*
          - $\overline{\text{m 1}}$ with 3 closed triangles .... *Pedomys*
    - Claws large, those on front feet usually longest.
      - Fur long and soft .... *Phaiomys*
      - Fur dense and mole-like .... *Pitymys*
- Palate highly abnormal.
  - Palate ending in a broad median plate cut off from maxillaries at the sides.
    - Third lower molar with all triangles closed .... *Neofiber*
    - Third lower molar without closed triangles.
      - Skull flat; audital bullæ small .... *Hyperacrius*
      - Skull high; audital bullæ large .... *Alticola*
  - Posterior border of palate continuous between maxillaries.
    - Posterior border of palate straight .... *Eothenomys*
    - Posterior border of palate with median projection .... *Anteliomys*

6. KEY TO THE SUBGENERA OF MICROTUS.[1]

[Based primarily on the teeth.]

- (*$\overline{m\ 1}$ with 6 or 7 closed triangles.*)
  - (*Plantar tubercles 5.*)
    - (*Small; not aquatic; fur short* .... *Chilotus*)
    - (*Large; aquatic; fur long* .... *Arvicola*)
  - (*Plantar tubercles 6* .... *Microtus*)
- **$\overline{\text{m 1}}$ with 5 closed triangles.**
  - **$\underline{\text{m 3}}$ with 3 closed triangles.**
    - **m 3 with triangles always closed .... Neofiber**
    - **m 3 with triangles normally open.**
      - **Plantar tubercles 6.**
        - **Fur not specially modified, claws moderate.**
          - **Posterior loop of $\underline{\text{m 3}}$ short or strongly curved; palate normal. Microtus**
          - (*Posterior loop of $\underline{m\ 3}$ long and straight; palate abnormal.*)
            - (*Skull broad and flat; plantar tubercles 5* .... *Hyperacrius*)
            - (*Skull not broad and flat; plantar tubercles 6* .... *Alticola*)
        - (*Fur very long and soft, aspect lemming-like, claws very long. Phaiomys*)
      - (*Plantar tubercles 5.*)
        - (*Small; not aquatic; fur short* .... *Chilotus*)
        - (*Large; aquatic; fur long* .... *Arvicola*)

---

[1] Characters in heavy-faced type are those of specimens with normal enamel pattern; characters in italics (inserted in parentheses) are those of specimens with abnormal enamel pattern.

- $\underline{m\ 3}$ with 2 closed triangles.
  - Triangles in $\overline{m\ 3}$ alternate and closed.
    - Aquatic; soles naked; tail long .... Neofiber
    - Not aquatic; soles hairy; tail short .... Lagurus
  - Triangles in $\overline{m\ 3}$ normally opposite and open.
    - Claws small, those on hind feet always longest.
      - Mammæ 8; foot pads 5.
        - Small; not aquatic; fur short .... Chilotus
        - *(Large; aquatic; fur long .... Arvicola)*
      - *(Mammæ 4; foot pads 5; skull high .... Pedomys)*
    - *(Claws large, those on front feet often longest.)*
      - *(Fur short and dense .... Pitymys)*
      - *(Fur long and soft .... Phaiomys)*

- $\overline{m\ 1}$ with 4 closed triangles.
  - $\underline{m\ 3}$ with posterior loop elongated in axis of jaw.
    - Skull broad and flat; plantar tubercles 5 .... Hyperacrius
    - Skull not broad and flat; plantar tubercles 6 .... Alticola
  - *($\underline{m\ 3}$ with posterior loop rounded or crescentic.)*
    - *($\underline{m\ 3}$ with 3 closed triangles .... Microtus)*
    - *($\underline{m\ 3}$ with 2 closed triangles .... Arvicola)*

- $\overline{m\ 1}$ with 3 closed triangles.
  - *($\underline{m\ 3}$ with 3 closed triangles.)*
    - *(Plantar tubercles 6.)*
      - *(Posterior loop of m 3 short or strongly curved; palate normal ... Microtus)*
      - *(Posterior loop of $\underline{m\ 3}$ long and straight; palate abnormal .... Alticola)*
    - *(Plantar tubercles 5.)*
      - *(Mammæ 8; palate normal .... Arvicola)*
      - *(Mammæ 4; palate abnormal .... Hyperacrius)*
  - $\underline{m\ 3}$ with 2 closed triangles.
    - Sole almost naked .... Arvicola
    - Sole hairy.
      - *(Palate abnormal .... Hyperacrius)*
      - Palate normal.
        - Claws long, all about equal in length .... Phaiomys
        - Claws short, those on front feet shortest .... Pedomys
  - *($\underline{m\ 3}$ with 1 closed triangle .... Hyperacrius)*

- $\underline{m\ 1}$ with 0 closed triangles.
  - $\underline{m\ 2}$ and $\underline{m\ 3}$ of approximately the same form .... Eothenomys
  - $\underline{m\ 2}$ and $\underline{m\ 3}$ very different in form .... Anteliomys

7. KEY TO THE SUBGENERA OF MICROTUS.

[Based primarily on mammæ and foot pads.]

- Mammæ 10 .... *Phaiomys*
- Mammæ 8.
  - Plantar tubercles 6.
    - Palate normal .... *Microtus*
    - Palate abnormal .... *Alticola*
  - Plantar tubercles 5.
    - Conspicuous musk glands on sides .... *Arvicola*
    - No musk glands on sides.
      - Color dark brown .... *Chilotus*
      - Color light grayish or yellowish .... *Lagurus*

- Mammæ 4.
  - Size very large .... *Neofiber*
  - Size medium or small.
    - Plantar tubercles 6 .... *Anteliomys*
    - Plantar tubercles 5.
      - Skull not flattened .... *Pedomys*
      - Skull flattened.
        - Palate normal .... *Pitymys*
        - Palate abnormal .... *Hyperacrius*

8. SUBGENERA OF MICROTUS GROUPED BY ESSENTIAL CHARACTERS.

Palate normal.—*Microtus, Pedomys, Pitymys, Chilotus, Phaiomys, Arvicola, Lagurus.*

Palate abnormal.—*Neofiber, Alticola, Hyperacrius, Eothenomys, Anteliomys.*

Third lower molar always with closed triangles.—*Neofiber, Lagurus.*

Third lower molar normally without closed triangles.—*Microtus, Pedomys, Pitymys, Chilotus, Phaiomys, Arvicola, Eothenomys, Anteliomys, Alticola, Hyperacrius.*

First lower molar normally with 5 closed triangles and 9 salient angles.—*Microtus, Chilotus, Neofiber, Lagurus.*

First lower molar normally with 3 or 4 closed triangles and 9 salient angles —*Pedomys, Pitymys, Phaiomys, Alticola, Hyperacrius.*

First lower molar normally with 3 closed triangles and 7 salient angles.—*Arvicola.*

First lower molar without closed triangles.—*Anteliomys, Eothenomys.*

Third upper molar normally with 3 closed triangles and 7 to 8 salient angles.—*Microtus.*

Third upper molar normally with 2 closed triangles and 6 salient angles.—*Neofiber, Arvicola, Pitymys, Pedomys, Phaiomys, Chilotus.*

Third upper molar without closed triangles.—*Anteliomys, Eothenomys.*

Mammæ 10.—*Phaiomys.*

Mammæ 8.—*Arvicola, Microtus, Alticola, Chilotus, Lagurus.*

Mammæ 4.—*Neofiber, Pitymys, Pedomys, Anteliomys, Hyperacrius.*

Plantar tubercles 6.—*Microtus, Phaiomys, Anteliomys, Alticola.*

Plantar tubercles 5.—*Neofiber, Arvicola, Pitymys, Pedomys, Chilotus, Lagurus, Hyperacrius.*

DESCRIPTIONS OF LIVING GENERA AND SUBGENERA.

Genus SYNAPTOMYS Baird.

Synaptomys Baird, Mamm. N. Am., p. 558, 1857. Type *Synaptomys cooperi* Baird.

Geographic distribution of type species.—Boreal, Transition, and northern edge of Upper Austral Zone in eastern North America from the Atlantic coast to Minnesota.

Geographic distribution of genus.—North America from northern edge of Lower Austral Zone northward.

Essential characters:

Upper incisors with distinct longitudinal grooves.

Lower incisors with roots on inner (lingual) side of molars.

Molars rootless.

Enamel pattern characterized by great depth of reentrant angles on outer side of maxillary teeth and on inner side of mandibular teeth.

$\overline{\mathrm{m}}$ 1 with three closed triangles and two transverse loops, or with four transverse loops and no closed triangles.

$\overline{\mathrm{m}}$ 3 with four transverse loops and no closed triangles.

Feet not specially modified.

Soles and palms with well-developed tubercles.

Thumb with large flattened ligulate nail.

Tail very slightly longer than hind foot, terete.

External ear well developed.

Skull.—The skull of *Synaptomys* (fig. 9 and Pl. I, figs. 12, 13) is moderately broad, flat, and massive, much less so than in the other *Lemmi.* Rostrum short (nasal bones about one-fourth occipito-nasal length) and strongly deflexed; zygomatic arches not broadly flaring as in *Lemmus* and *Dicrostonyx*,[1] though more so than in the voles; middle portion of zygoma very slightly expanded, the outer surface nearly vertical; brain case not greatly broadened or flattened, and seldom if ever conspicuously ridged or furrowed; interparietal with rounded corners, the antero-posterior diameter more than half the transverse diameter; pterygoids short; interpterygoid fossa about one-sixth basilar length of skull; posterior border of bony palate ending nearly as in typical *Microtus.* (See p. 26, Pl. II, fig. 5, and fig. 7, p. 27.) Front edge of squamosal forming a narrow, shelf-like postorbital process.

Teeth.—Anterior faces of upper incisors with distinct longitudinal grooves. Lower incisor terminating posteriorly a little in front of the hinder edge of the back molar. Throughout its length each mandibular incisor lies wholly on the inner (lingual) side of the molar series. (Pl. III, fig. 1.)

The molars are all rootless. The upper molar series is about one-third the basilar length of skull, the lower series slightly less. The enamel pattern (figs. 8 and 10) is characterized by the great depth of the outer reentrant angles in the maxillary teeth and of the inner reentrant angles in the mandibular teeth. Of the maxillary teeth $\underline{\text{m 1}}$ and $\underline{\text{m 2}}$ show no important peculiarities of form except that the outer reentrant angles cut across to the enamel of the extreme inner side, a feature shared by *Lemmus* alone. The posterior upper molar, however, like that of *Lemmus*, differs widely from the corresponding tooth in all other *Microtinæ.* It is formed of four transverse loops. The first and second of these loops are isolated by two deep reentrant angles on the outer side of the tooth, while the third is formed by an equally deep depression on the inner side. The reentrant angles and closed triangles on the inner side of the mandibular molars are greatly developed at the expense of those on the outer side. In the subgenus *Mictomys* the latter wholly disappear except in the last tooth. This has a reentrant angle near the middle, but no closed triangle.

External form.—In general appearance *Synaptomys* resembles the *Microti* much more closely than it does the *Lemmi*, a fact which has given rise to the rather inappropriate names 'lemming-vole' and 'false lemming.' The species of *Synaptomys* are thick-set microtines with large heads, ears that just appear above the moderately long fur, short tails, and small feet. In color they are all dull brownish, darker on the back, paler on the belly. The palms and soles are tuberculate, as in the voles.

General remarks.— *Synaptomys* differs from all the other genera of

---

[1] The ratio of zygomatic breadth to basilar length is approximately 70 in *Synaptomys*, 75 in *Lemmus* and *Dicrostonyx*, and 65 in *Microtus.*

Microtinæ in its grooved incisors. From the other lemmings it may be known by its unmodified external form, and from the voles by the characters of its molars.

Subgenus SYNAPTOMYS Baird.

Synaptomys Baird, Mamm. N. Am., p. 558, 1857. Type *Synaptomys cooperi* Baird.

Geographic distribution of type species.—Boreal, Transition, and northernmost edge of Austral zone in eastern United States and adjoining British Provinces; west to Minnesota, south to Iowa, Indiana, Ohio, and Maryland.

Geographic distribution of subgenus.—Boreal zone to northern edge of Lower Austral zone in eastern Canada and eastern United States; west to Minnesota, south to Kansas and Virginia.

Essential characters:

Rostrum very heavy.
Palate nearly as in true *Microtus.*
Mandibular molars with closed triangles on outer side
Mammæ 6.

Skull.—The skull of true *Synaptomys* (fig. 9 and Pl. I, fig. 13) differs from that of *Mictomys* in the remarkably heavy rostrum and in certain slight details in the form of the bony palate. The latter is almost exactly as in typical *Microtus*, the slight peculiarities in form being well within the limits of variation in the latter.

Teeth.—The incisors in true *Synaptomys* are, like the rostrum, excessively strongly built. The grooves are usually sharply defined and placed near the outer edges of the teeth.

The maxillary teeth differ in no way from those of the species of *Mictomys.* In the molars of the lower jaw, however, the outer edge of each tooth is cut by a deep reentrant angle which isolates a large outer triangle (fig. 8).

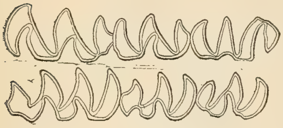


FIG. 8.—Enamel pattern of molar teeth of *Synaptomys cooperi.* (x 5.)

Mammæ.—The number of mammæ in *Synaptomys* has been variously recorded as four and six. Dr. Coues, in his monograph of the American *Microtinæ*, states that he finds six, four pectoral and two inguinal, in a female from Brookville, Ind.[1] Quick and Butler,[2] however, noted only four, two pectoral and two inguinal, in specimens from the same locality. Mr. Vernon Bailey records six mammæ in a female collected for the United States Department of Agriculture at Ann Arbor, Mich., and I find the same number in an alcoholic specimen taken at Rogersville, Tenn. It is probable that six is the normal number, and that Quick and Butler overlooked the posterior pair on the breast, as these are smaller than the others, at least in the alcoholic specimen from Tennessee.

---

[1] Monogr. N. Am. Rodentia, p. 236.
[2] American Naturalist, XIX, p. 114.

General remarks.—The characters distinguishing the subgenera *Synaptomys* and *Mictomys* are discussed under the latter.

Three species of true *Synaptomys* are now known: *S. cooperi* Baird, *S. fatuus* Bangs, and *S. helaletes* Merriam.[1]

Subgenus MICTOMYS True.

1894. *Mictomys* True, Proc. U. S. Nat. Mus., XVII, No. 999, p. 242. Advance sheet, April 26, 1894 (full genus). Type *Mictomys innuitus* True.

1896. *Mictomys* Merriam, Proc. Biol. Soc. Washington, X, p. 57, March 19, 1896 (subgenus).

Geographic distribution of type species.—*Synaptomys innuitus* is known from the type locality only, Fort Chimo, Ungava, Labrador.

Geographic distribution of subgenus.—Hudsonian zone from Labrador to Alaska, south to northern California.

Essential characters:

Rostrum slender.
Palate not as in true *Microtus*.
Mandibular molars without closed triangles on outer side.
Mammæ 8.

Skull.—The skull of *Mictomys* is in general much like that of *Synaptomys* proper, but the whole rostral part (including incisors) is disproportionally slender and weak (fig. 9, and Pl. I, fig. 12). The bony palate is formed on the same plan as that of true *Synaptomys* or of *Microtus* proper, but differs from both of these in the prolongation of the median ridge as a spine projecting into the interpterygoid fossa.

The pterygoids are usually longer and more slender than in *Synaptomys*, and the hamular processes less strongly bent outward.

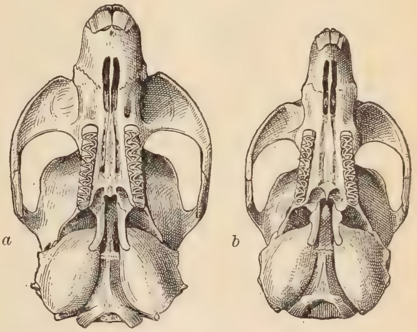


FIG. 9.—*a. Synaptomys helaletes; b. Synaptomys wrangeli.*

Teeth.—The incisors in *Mictomys* are much smaller in proportion to the size of the skull than in the subgenus *Synaptomys*. The grooves in the upper incisors are usually nearer the middle of the tooth, and less well defined than in true *Synaptomys*.

The maxillary teeth (fig. 10) are exactly as in the subgenus *Synaptomys*. The lower molars, however, differ from those of true *Synaptomys* in the absence of reentrant angles on the outer borders of all but the hindermost. Even in this the reentrant angle is never deep enough to isolate an outer triangle.

Mammæ.—In the type of *Synaptomys innuitus* there are eight mammæ, two more than have been recorded in *Synaptomys* proper. Whether this difference is constant or otherwise, it is, however, impossible to say.

---

[1] See Merriam, Proc. Biol. Soc. Washington, X, p. 57, 1896.

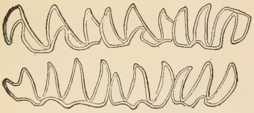


FIG. 10.—Enamel pattern of molar teeth, *Synaptomys innuitus*. (x 5.)

General remarks.—*Mictomys* was first described as a full genus, but the characters on which it rests are of no more than subgeneric importance. The group is distinguished from true *Synaptomys* by the slender rostrum and incisors, slightly different form of bony palate, crenulate outer border of lower molars, and probably by the number of mammæ also.

Four species of *Mictomys* have thus far been described, *Synaptomys innuitus* (True), *S. wrangeli* Merriam, *S. dalli* Merriam, and *S. truei* Merriam.[1]

Genus LEMMUS Link.

1795. *Lemmus* Link, Zool. Beyträge, I, Pt. II, p. 75, 1795. Type by elimination *Mus lemmus* Linn.
1811. *Myodes* Pallas, Zoogr. Rosso-Asiat., I, p. 172, 1811 (part).
1877. *Myodes* Coues, Monogr. N. Am. Rodentia, p. 237, 1877, and most subsequent authors.

Geographic distribution of type species.—Arctic region in Asia and eastern Europe.

Geographic distribution of genus.—Arctic region in both hemispheres.

Essential characters:

Upper incisors without grooves.
Lower incisors with roots on inner (lingual) side of molars.
Molars rootless.
Enamel pattern as in *Synaptomys.*
Feet highly modified.
Palms and soles without well-developed tubercles.
Thumb with large flattened 'strap-shaped' nail.
Tail shorter than hind foot, terete.
External ear small but well developed.

Skull.—The skull of *Lemmus* (Pl. I, fig. 6) is perhaps the most highly modified in the family *Microtinæ.* The rostrum, like that of *Synaptomys*, is short in proportion to the length of the skull (nasal bones contained about three and one-half times in occipito-nasal length), the dorsal profile bent abruptly downward. Zygomatic arches very abruptly and broadly flaring, each expanded near the middle into a wide, strongly oblique plate.[2] Brain case broad, flat, and subquadrate in outline, but dwarfed in appearance by contrast with the large zygomata. Pterygoids short (about as in *Synaptomys*). Bony palate terminating essentially as in *Synaptomys*, but lateral pits very deep and anterior edge of interpterygoid fossa carried forward over (dorsad to) overhanging edge of palate (Pl. II, fig. 14). The anterior edge of the squamosal forms a narrow but distinct shelf-like postorbital process, much as in *Synaptomys*, but more strongly developed.

---

[1] See Merriam, Proc. Biol. Soc. Washington, X, p. 61, 1896.

[2] These plates may be nearly 5 mm. across in the widest part.

Teeth.—The dentition of *Lemmus* is essentially the same as that of *Synaptomys*. The upper incisors are, however, much more slender in proportion to the size of the skull, and are without the peculiar grooves always present in *Synaptomys*. In the pattern of enamel folding, the only difference between the two genera is that the third transverse loop in the hindermost maxillary tooth is isolated by a single reentrant angle in *Synaptomys*, and by the contact of two reentrant angles in *Lemmus* (fig. 11).

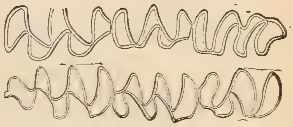


FIG. 11.—Enamel pattern of molar teeth, *Lemmus lemmus*. (x 5.)

External form.—In external form the species of *Lemmus* differ very widely from all other microtines except *Dicrostonyx*. The head is disproportionately large for the short thick body,[1] while the tail is reduced to a mere rudiment only about two-thirds as long as the hind foot. The feet are highly modified to fit the animals to their fossorial habits. While the hind feet are unusually large and strong, the front feet are even more specialized. The thumb is provided with a large ligulate nail and the fingers are armed with long, sharp claws (fig. 12). The claws are, however, simple in form and are not subject to the periodic changes that occur in those of *Dicrostonyx*.

In the alcoholic specimens that I have examined the palms show no trace of tubercles, but the soles bear indications of several very small and exceedingly rudimentary pads close to the base of the toes. The fur is remarkably long and dense, the palms and soles densely furred, and the tail provided with a pencil of stiff bristle-like hairs longer than the tail vertebræ.

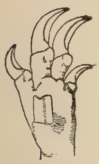


FIG. 12.—Left front foot, *Lemmus lemmus* (hair removed).

General remarks.—The species of *Lemmus* are true lemmings with highly modified skull and external form. With these characters they combine the dentition of *Synaptomys* without, however, the peculiar incisors of the latter. *Lemmus* differs from *Synaptomys* in its highly modified skull and external form as well as in the dental character just mentioned. From *Dicrostonyx* it is distinguished by cranial and dental characters and by the well-developed external ears (fig. 15), as well as by the simple claws and large thumb nail.

The species of *Lemmus* at present recognized are *L. lemmus* (Linnæus), *L. obensis* (Brants), *L. schisticolor* (Lilljeborg), and *L. nigripes* (True).

---

[1] This peculiarity is carried even further in *Lemmus* than in *Synaptomys*.

Genus DICROSTONYX Gloger.

1830. *Cuniculus* Wagler, Nat. Syst. d. Amphibien, p. 31, 1830 (part).
1877. *Cuniculus* Coues, Monogr. N. Am. Rodentia, p. 243, 1877.
1841. *Dicrostonyx* Gloger, Gemeinn. Hand- u. Hilfsbuch d. Naturgesch., pp. XXXI, 97, 1841. Type, an American species, probably *Mus hudsonius* Pall.
1854. "*Myolemmus* Pomel, Ann. Sci. Soc. Auvergne, 1854" (fide Trouessart).
1855. *Misothermus* Hensel, Zeitschr. der Deutsch. geolog. Gesellsch., VII, p. 492, 1855. Type *Myodes torquatus* Pall.
1881. *Borioikon* Polyakoff, Mém. Acad. Imp. Sci. St. Petersbourg, XXXIX, suppl. p. 34, 1881. Type *Myodes torquatus* Pall.

Geographic distribution of type species.—Arctic America.

Geographic distribution of genus.—Arctic region in both hemispheres.

Essential characters:

Upper incisors without grooves.
Lower incisors with roots on inner (lingual) side of molars.
Molars rootless.
Enamel pattern characterized by approximate equality of reentrant angles.
$\overline{\text{m}}\ 1$ with 7 closed triangles and 2 transverse loops.
m 3 with 3 or 4 closed triangles and 2 transverse loops.
Feet highly modified.
Palms smooth; soles with rudimentary tubercles.
Thumb with a rudimentary nail.
Tail shorter than hind foot, terete.
External ear rudimentary.

Skull.—The skull of *Dicrostonyx* (Pl. I, fig. 14) in a general way resembles that of *Lemmus*, but is smaller and more lightly built. The zygomata are less broadly flaring and the expansion near the middle is comparatively slight. The outer face of the expanded portion, as in *Lemmus*, is strongly oblique. The rostrum is also lighter and more slender. While the pterygoids are proportionally longer than in *Lemmus*, the posterior edge of the bony palate is formed exactly as in the latter (Pl. II, figs. 12 and 14). The anterior edge of the squamosal gives off a conspicuous peg-shaped postorbital process very different from the postorbital process in *Lemmus* or any of the other *Microtinæ*. These pegs are especially conspicuous when the skull is viewed from the ventral aspect.

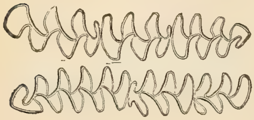


Fig. 13.—Enamel pattern of molar teeth, *Dicrostonyx* from Ungava, Labrador. (x 5.)

Teeth.—Incisors essentially as in *Lemmus*. Molars rootless. Pattern of enamel folding (fig. 13) very different from that of either of the other genera of *Lemmi* and in some respects resembling that of the *Microti*. The reentrant angles on the opposite sides of the teeth are approximately equal in depth, thus producing closed triangles of nearly the same size on the two sides. The first lower molar contains seven closed triangles in addition to a transverse loop at each end. The second lower molar contains a posterior loop followed by four alternating closed triangles and an anterior transverse loop, which is much flattened and so small that the tips of the salient angles do not reach to the level of the tips of the other salient angles of the tooth. Occasionally the anterior outer triangle opens into the transverse loop. The posterior lower molar has a posterior transverse loop followed by three large closed or nearly closed triangles (two on the inner side), and a fourth smaller triangle on the outer side.[1] The maxillary teeth have each a large anterior loop. This is followed in the first by five alternating closed triangles and a small postero-external loop, in the second by four closed triangles and a small postero-external loop, and in the third by four closed triangles and a small rounded terminal loop.

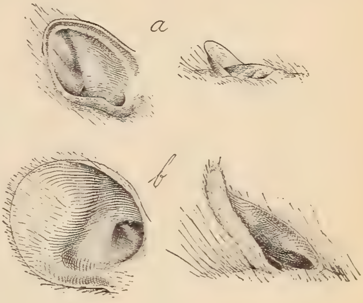


Fig. 14.—Ear, (*a*) *Dicrostonyx*, (*b*) *Lemmus* (double natural size)

External form.—In external form the species of *Dicrostonyx* are even more specialized than the members of the genus *Lemmus*. As in the latter, the head is very large, the tail is reduced to a stub, shorter than the hind foot, and the feet are highly modified for digging. The external ears are, however, mere naked folds of integument lying just behind the meatus (fig. 14 *a*). The fur is long and dense, much as in *Lemmus*. The palms and soles are densely furred, and the tail is provided with a stiff pencil of bristle-like hairs, longer than the tail vertebræ. The hind feet are very broad, the breadth at base of toes being about one-half length of foot.[2] On the hind foot there are several minute, faintly developed tubercles near the base of the toes. The palms are, however, perfectly smooth. The claws on the hind feet are large and well formed, though in no way different from those of *Lemmus*. Those on the front feet are very highly modified, and present seasonal changes in size and form unknown elsewhere among the *Microtinæ*. The thumb (fig. 15) is greatly reduced in size. The thumb nail is so small as readily to escape notice, but the ball of the thumb projects as a distinct tubercle, the surface of which is covered with a thick layer of corneous tissue. The claws on the second and fifth fingers are large, though not peculiar in form. The two middle claws, on the contrary, while in summer not different from those of *Lemmus*, are in winter very greatly enlarged (fig. 15), and

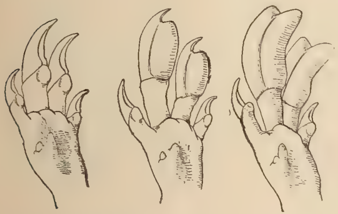


Fig. 15.—Left front foot of three specimens of *Dicrostonyx* from Alaska, showing successive stages in the development of the claws (hair removed).

---

[1] In *Dicrostonyx torquatus* there is a minute supplemental anterior internal loop which is absent in the species that occurs in Labrador.

[2] In *Lemmus* this breadth is only about one-third length of foot.

wholly unlike those of any other microtine. Dr. Coues's description of the claws of *Dicrostonyx* is so interesting that it may be quoted almost entire. He says (Monogr. N. Am. Rodentia, pp. 248, 249):

> The two middle fore claws attain their maximum of development in winter. In spring and early summer these claws do not appear very different from those of *Myodes* [=*Lemmus*], though averaging larger, more bulbous at base underneath, with the terminal portion slenderer, straighter, and sharper. This bulbous portion underneath grows out simultaneously with increase in length and amount of curvature of the main portion of the claw, until it equals or even exceeds the length of the latter, and is quite as stout, or even stouter, being somewhat broad and pad-like. At this period it runs the whole length of the claw, from which it is separated by a groove along the sides, and by a notch at the end, both of varying depth. The claw then looks nearly like two claws, one underneath the other. The pad would then seem to gradually sever its connection with the main claw by progressive increase in depth of the constriction marked by the lateral groove and terminal notch, as well as by loosening from the base, when it appears like an excrescence; it is finally lost. Thus the process appears to be a periodical one, like the shedding of the horns of ruminants, and not continually progressive with age; and would seem to be connected with the particularly fossorial habits of the quasi-hibernating animal that digs galleries under ground in which to reside during the cold season, as compared with its freer and more active mode of life in summer. At the period of the maximum development of the claws these equal or surpass half an inch in length. * * *

General remarks.—*Dicrostonyx* is so readily distinguished by its peculiar dentition, highly modified feet, and rudimentary external ears, that it requires no detailed comparison with any other genus.

While *Dicrostonyx torquatus* (Pallas) is the only species now recognized, there are doubtless several others.

Genus PHENACOMYS Merriam.

1889. *Phenacomys* Merriam, North American Fauna No. 2, p. 28, October 30, 1889.

Geographic distribution of type species.—*Phenacomys intermedius* is known only from the type locality, Kamloops, British Columbia.

Geographic distribution of genus.—Boreal North America; also recorded from the bone breccia of Beremend, southern Hungary, and the Forest Beds of Norfolk and Suffolk, England (Nehring, Naturwissenschaftliche Wochenschrift, Nr. 28, p. 346, July 15, 1894.)[1]

Essential characters:

Upper incisors without grooves.

Lower incisors with roots on outer side of molars.

Molars rooted.

Enamel pattern characterized by approximate equality of reentrant angles in maxillary teeth and great depth of reentrant angles on inner side of mandibular teeth.

$\overline{\text{m 1}}$ with five closed triangles.

$\underline{\text{m 3}}$ with two or three closed triangles,

---

[1] I have not seen the original description of the remains from Beremend (described by Nehring in Naturwissenschaftliche Wochenschrift, 1883). The teeth from the Forest Beds represent an animal which is certainly not *Phenacomys*. (See note on *Arvicola intermedius* Newton on page 75.)

Bony palate not terminating in a thin-edged shelf continuous between alveoli of posterior incisors.

Feet not specially modified.

Thumb with a small pointed nail.

Tail longer than hind foot, terete.

Fur not specially modified.

Skull.—The skull of *Phenacomys* (Pl. I, fig. 5) differs very slightly in general form from that of typical *Microtus*. The brain case is, however, flatter and more quadrate (but no more so than in the subgenera *Lagurus* and *Pitymys*), and the zygomata bend down somewhat more abruptly in front. The expansion of the zygoma at the region of contact between the malar and the zygomatic process of the maxillary is rather more abrupt than is usual in *Microtus*, but the difference is very trifling. The postorbital processes of the squamosals are slightly more prominent and angular than in *Microtus arvalis* or *M. pennsylvanicus*, but scarcely more developed than in *M. agrestis*, and considerably less so than in *M. alleni*. The audital bullæ are proportionally about the same size as or slightly smaller than in *Microtus arvalis*. They are more globular and less 'subfusiform' than in the typical species of true *Microtus*, but closely resemble those of *M. agrestis*. The palate (Pl. II, fig. 1) is formed essentially as in the members of the subgenus *Lagurus* (Pl. II, figs. 3 and 4).

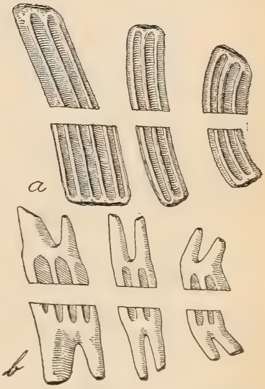


Fig. 16.—Side view of molars, *Phenacomys*. (*a*) young, (*b*) adult. (x 3.)

Teeth.—The teeth of *Phenacomys* differ in many ways from those of the other voles. In young individuals the molars (fig. 16) are rootless, but by the time the animals are full grown each molar has developed two distinct roots, which, however, remain open until an advanced age, though not so long as in the genus *Evotomys*. The pattern of enamel folding (fig. 17) is essentially the same as that of the voles of the subgenera *Pedomys* and *Phaiomys*. (See pp. 56 and 57.) The differences are to be found in the lower molars where the reentrant angles on the inner side are proportionally deeper and those on the outer side proportionally shallower than in *Pedomys*. There is a corresponding difference in the size of the closed triangles on the opposite sides of the teeth. The anterior outer loop in the second lower molar is especially reduced.

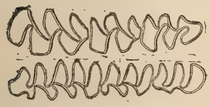


Fig. 17.—Enamel pattern of molar teeth, *Phenacomys celatus*. (x 5.)

In *Phenacomys* the root of the lower incisor runs back between the roots of the second and third molars, and terminates on the outer side of the tooth row in the ascending ramus of the jaw, at about the level of the middle of the posterior molar, and distinctly below the dental foramen. (Pl. III, fig. 2.) While exactly this condition is not found elsewhere except in *Evotomys*, it is somewhat closely approached in *Fiber*.

External form.—In external form the species of *Phenacomys* show no peculiarities to distinguish them from the other voles. The body, tail, feet, ears, and eyes are usually proportioned about as in *Microtus arvalis* or *M. austerus*. In *P. longicauda*, however, the tail is proportionally longer than in any of the other known species.

General remarks.—*Phenacomys* is readily distinguished from *Microtus* by the rooted molars. From *Evotomys*, *Phenacomys* is separated by certain characters in the form of the skull, and more especially of the bony palate, as well as by peculiarities in the teeth. The differences between the three genera may be compared in detail as follows:

Microtus.	*Evotomys.*	*Phenacomys.*
Root of lower incisor above dental foramen.	Root of lower incisor below dental foramen.	Root of lower incisor bolow dental foramen.
Molars rootless throughout life..	Molars rooted in the adult, the roots closed in extreme old age.	Molars rooted in the adult, the roots closed in extreme old age.
Molars large and strong, the salient angles sharp.	Molars small and weak, the salient angle rounded.	Molars large and strong, the salient angles sharp.
Reentrant angles on outer and inner sides of lower molars approximately equal in depth.	Reentrant angles on outer and inner sides of lower molars approximately equal in depth.	Reentrant angles on inner side of lower molars very much deeper than those on outer side.
Skull strong and angular........	Skull weak and rounded........	Skull strong and angular.
Posterior border of bony palate extremely variable.	Posterior border of bony palate a thin-edged shelf continuous between alveoli of posterior molars.	Posterior border of palate never a thin-edged shelf.
Middle portion of zygoma distinctly expanded.	Middle portion of zygoma scarcely expanded.	Middle portion of zygoma distinctly expanded.

Since the discovery of the genus *Phenacomys* the following species have been described: *P. intermedius* Merriam, *P. celatus* Merriam, *P. ungava* Merriam, *P. latimanus* Merriam, *P. orophilus* Merriam, *P. longicauda* True, *P. truei* Allen, and *P. oramontis* Rhoads. The status of these forms is wholly a matter of conjecture.

Genus EVOTOMYS Coues.

1839. *Myodes* DeSélys Longchamps, Études de Micromammalogie, p. 87, 1839 (section).
1883. *Myodes* Lataste, Le Naturaliste, Tome II, p. 349, 1883 (subgenus).
1840. *Hypudæus* Keyserling and Blasius, Die Wirbelthiere. Europas, p. 34, 1840 (subgenus). Type *Mus glareolus* Schreber. (Not *Hypudæus* Illiger, 1811.)
1857. *Hypudæus* Baird, Mamm. N. Am., p. 513, 1857 (subgenus).
1874. *Evotomys* Coues, Proc. Acad. Nat. Sci. Phila., p. 186, 1874 (genus). Type *Mus rutilus* Pall

Geographic distribution of type species.—Arctic region in Europe and Asia, possibly in America also.

Geographic distribution of genus.—Boreal North America, Asia, and Europe.

Essential characters:

Upper incisors without grooves.
Lower incisors with roots on outer side of molars.
Molars rooted.
Enamel pattern characterized by approximate equality of reentrant angles.
$\overline{\text{m 1}}$ with five closed or nearly closed triangles.
$\underline{\text{m 3}}$ with three closed triangles.
Feet not specially modified.
Thumb with a small, pointed claw.
Fur not specially modified.
Tail longer than hind foot, terete.

Skull.—The skull of *Evotomys* (Pl. I, fig. 4), as compared with that of the other voles, is characterized by a general weakness and lack of angularity. All the outlines are full and rounded, and the ridges and furrows are slightly developed, even in extreme old age. The interorbital region is broader and the audital bullæ are larger and more inflated than usual in *Microtus* and *Phenacomys*. On the other hand, the zygomata are very slender and scarcely widened in the region of contact between the jugal and the zygomatic process of the maxillary. The mandible also is slender and weak. The bony palate terminates in a thin-edged shelf, continuous between the alveoli of the posterior incisors (fig. 7 and Pl. II, fig. 10). The structure is very different from that found in *Phenacomys* and in typical *Microtus*.[1]

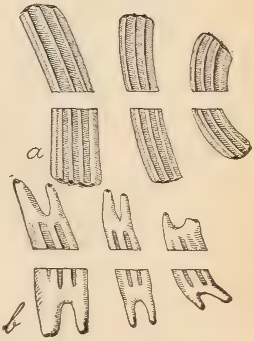


FIG. 18.—Side view of molars, *Evotomys*. (*a*) young, (*b*) adult. (x 3.)

Teeth.—The incisors are exactly as in *Phenacomys*. The lower incisor runs back along the lingual side of the first and second molars, but crosses the line of the molar tooth row between the second and third molars, terminating in the ascending ramus of the mandible at about the level of the middle of the posterior molar and distinctly below the dental foramen. The molars are rootless in the young (fig. 18), but in the adult each is provided with two distinct roots which eventually become fully closed.[2] In one very old individual the crowns of the lower molars are completely worn away, so that each root, with the exception of the anterior root of $\overline{\text{m 3}}$ (which has been shed) stands alone like a simple, round-topped tooth (Pl. III, fig. 4). The molars are all very narrow and weak, in this character strongly contrasted with the strong, broad teeth of *Microtus* and *Phenacomys*.

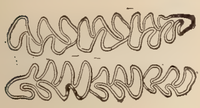


FIG. 19.—Enamel pattern of molar teeth, *Evotomys gapperi*. (x 5.)

---

[1] For detailed comparison of the palates of *Evotomys* and *Microtus* see pages 26–28.

[2] In the original description of the genus *Phenacomys* (North Am. Fauna No. 2, p. 30) it is stated that "*Phenacomys* has genuine rooted molars, not half-rooted molars like those of *Evotomys*, which grow from persistent pulps." *Evotomys*, however, has as perfectly rooted molars as *Phenacomys*, though the roots do not close so early in life.

In the number and arrangement of triangles the enamel pattern (fig. 19) is the same as that of the tetramerodont species of *Microtus* (see p. 65). The salient angles are, however, for the most part rounded, and so placed that the triangles are seldom fully closed.

External form.—In external form *Evotomys* does not differ essentially from *Microtus*, although the ears are usually larger. The red or rufous color of most of the species gives them a very different appearance from the other voles.

General remarks.—The characters which separate *Evotomys* from *Microtus* and *Phenacomys* have been presented in such detail under the latter that it is unnecessary to consider them further. The peculiar bony palate of *Evotomys* has been considered one of the best generic characters. Since the discovery that it is perfectly reproduced in two subgenera of *Microtus* (*Anteliomys* and *Eothenomys*) it loses much of its importance.

The genus *Evotomys* is represented in Europe, Asia, and North America by numerous species and subspecies whose interrelationships are at present little understood. Among the American species may be mentioned *E. gapperi* (Vigors), *E. fuscodorsalis* Allen, *E. galei* Merriam, *E. idahoensis* Merriam, *E. californicus* Merriam, and *E. occidentalis* Merriam; among those found in the Old World are *E. rutilus* (Pallas), *E. glareolus* (Schreber), and *E. rufocanus* (Sundevall).

Genus MICROTUS Schrank.

1798. *Microtus* Schrank, Fauna Boica, I, 1ste Abth., p. 72, 1798. Type by elimination *Microtus terrestris* Schrank = *Mus arvalis* Pall.

1883. *Microtus* Lataste, Le Naturaliste, Tome II, p. 348, 1883.

1801. *Arvicola* Lacépède, Mém. de l'Institut, III, p. 489, 1801. Type '*Arvicola amphibius*' = *Mus terrestris* Linn.

Geographic distribution of type species.—Central Europe and parts of Asia.

Geographic distribution of genus.—In both hemispheres the genus *Microtus* ranges from near the northern limit of mammalian life to the edge of the tropics.

Essential characters:

Upper incisors without grooves.
Lower incisors with roots on outer side of molar series.
Molars rootless.
Enamel pattern characterized by approximate equality of reentrant angles.
$\overline{\text{m 1}}$ usually with five closed or nearly closed triangles.
$\underline{\text{m 3}}$ with one, two, or three closed triangles.
Tail nearly always longer than hind foot, terete.
Feet, fur, eyes, and ears very variable.
Thumb never with a well-developed ligulate nail.

Skull.—The skull of *Microtus* varies greatly in shape among the different subgenera. Full descriptions will be given under each of these. Considering the genus at large it is difficult to frame any diagnosis by which the skull may be in every case distinguished from that of the other voles. Most of the characters which at various times have been brought forward for this purpose prove to be either wholly inconstant or constant only when particular subgenera are held in view.

Teeth.—Although the skull of *Microtus* presents no tangible diagnostic characters, the teeth are readily distinguishable from those of all other members of the subfamily. The upper incisors are never grooved except in occasional abnormal specimens. The root of the lower incisor crosses the line of the molar series between the second and third molars, causing a greater displacement of the roots of the latter (Pl. III, fig. 3) than occurs in any other genus. It terminates in the ascending ramus of the mandible at a point slightly above and behind the dental foramen (Pl. III, fig. 3). The molars, even in extreme old age, are never rooted (fig. 20). This character alone distinguishes them from the molars of the other voles. The pattern of enamel folding varies considerably in the different subgenera, and forms one of the numerous characters by which the latter may be separated. Detailed descriptions of the enamel patterns are given in the accounts of the subgenera.

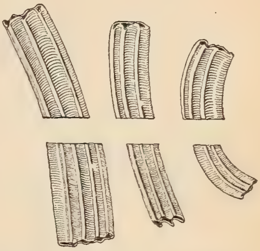


Fig. 20.—Side view of molars of adult *Microtus alleni*. (x 2.)

External form.—In external form the members of the genus *Microtus* vary excessively. Some resemble lemmings so closely that they have been associated with these by certain writers. Others are modified for an aquatic life and in consequence have more the appearance of musk-rats (*Fiber*). Still others pass most of their time under ground. In these the ears, eyes, and tail are reduced, the front feet enlarged, and the fur so modified as to suggest that of the moles. The great majority of species, however, show none of these special adaptations, but resemble in a general way the members of the genera *Phenacomys* and *Evotomys*. Whatever may be the modifications in form, the tail is almost invariably longer than the hind foot and the thumb is armed with a small or rudimentary pointed nail (fig. 21).

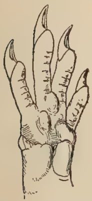


Fig. 21.—Left front foot, *Microtus terrestris*.

General remarks.—The characters of *Microtus*, as contrasted with *Evotomys* and *Phenacomys*, have already been given (p. 42) and need not be repeated here.

Subgenus EOTHENOMYS[1] Miller.

New subgenus. Type *Arvicola melanogaster* Milne-Edwards.

Geographic distribution of type species.—Moupin, western Sechuen, and western Fokien, China. (Blanford.)

Geographic distribution of subgenus.—*Microtus melanogaster* is the only known species of *Eothenomys*, hence the geographic distribution of the subgenus is the same as that of the type species.

---

[1] Ἠώς, the morning (eastern); θεν, from; μῦς, mouse.

Essential characters:

Palate abnormal.
$\overline{\text{m 3}}$ without closed triangles.
$\overline{\text{m 1}}$ with triangles frequently open and 8 or 9 salient angles.
$\underline{\text{m 3}}$ with triangles usually open and 6 salient angles.
Mammæ (number not known).
Plantar tubercles, 5.
Sole hairy.
Claws on hind feet longest.
Fur apparently somewhat modified.

Skull.—In the specimens of *Eothenomys* that I have examined the skull is not in sufficiently good condition to permit of any detailed description. The peculiar structure of the bony palate taken in connection with the teeth is, however, of itself enough to characterize the group.

Bony palate.—Unfortunately in the two specimens of *Microtus melanogaster* that I have seen (82.6.16.11 and 92.10.12.5, British Museum Register) the basal part of the skull is so injured that the form of the interpterygoid fossa can not be determined. The bony palate, however, is sufficiently preserved to show the essential details of its structure (Pl. II, fig. 11). That part of the palate which lies in the level of the roof of the mouth ends abruptly opposite the front end of the back upper molar in a straight-edged shelf which extends without notch or projection from alveolus to alveolus. Although the form is thus strikingly different from that of the typical microtine palate, the vestiges of the structure there present may still be recognized. The lateral grooves and median ridge are present, though slightly developed. The former terminate in two depressions lying just in front of the wide, flat, lateral bridges which completely obliterate the posterior ends of the grooves, and together with the terminal part of the median ridge form the edge of the palatal shelf. The palate in all its essential characters is thus exactly like that of *Evotomys*.

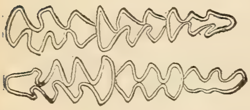


Fig. 22.—Enamel pattern of molar teeth, *Microtus* (*Eothenomys*) *melanogaster*. (x 5.)

Enamel pattern in general.—The enamel pattern in *Eothenomys* (fig. 22) is in many ways remarkable. The triangles in all the teeth tend to remain open, the points of the salient angles are blunt and rounded as in *Evotomys*, the triangles on the outer and inner sides of the teeth are subequal in size, and the maxillary teeth are especially noticeable for their likeness to each other. The figures published by Blanford[1] fail to do justice to the teeth of this species. These are better represented in Milne-Edwards's original plate,[2] in which there is also a hint at the palate structure.

---

[1] Journ. Asiatic Soc. Bengal, L, pt. II, Pl. II, fig. A.

[2] Recherches p. servir à l'histoire nat. d. Mammifères, Vol. I, Pl. XLVI, figs. 1c and 1d.

Front lower molar.—The first lower molar has the usual transverse posterior loop and a moderately long rounded anterior loop, with a strong salient angle at each side of the base. It has five lateral triangles, three on the inner side, two on the outer side. These may be perfectly isolated, or more often widely open. Except for the greater tendency to equality in the triangles, the teeth in the lower jaw do not differ very greatly from the mandibular teeth of true *Microtus.*

Back upper molar.—The posterior maxillary tooth most nearly resembles that of *Pedomys.* The anterior loop is followed by two lateral triangles, subequal in size and more or less completely isolated from each other and from the anterior loop. The third lateral triangle is reduced to a strongly developed salient angle on the inner side of the posterior transverse loop. A second salient angle is formed on the outer side of this loop, which thus appears as a crescent joined near the middle of its concavity to the rest of the tooth.

Other teeth.—The middle upper molar has a postero-internal loop nearly as large as the postero-external loop, the two placed opposite each other. The result is a tooth of practically the same shape as the one behind it. The anterior upper molar is likewise provided with a very large postero-internal loop opposite the loop on the outer side, normally terminating the tooth. Thus it very closely resembles the two other maxillary teeth, differing only in its one more closed triangle at the front end.

Mammæ.—The number of mammæ in *Eothenomys* is unknown.

Feet.—The feet are moderately hairy, in this respect not differing from true *Microtus.* Blanford states that there are five well-developed pads on the sole and a rudimentary sixth. The claws are not greatly developed on any of the feet; those on the hind feet are the longest.

Fur.—A skin in the British Museum has the fur of a peculiar, dense, mole-like quality suggestive of *Pitymys.* The specimen appears to be in worn coat, however, and this character may not be normal.

General remarks.—*Eothenomys* is such a well-marked subgenus that it is surprising to find that it has hitherto received no name. In tooth pattern it agrees in a general way with *Microtus sikkimensis,* a circumstance which induced Blanford to place it in the subgenus '*Neodon;*' but the palate structure is widely different from that of the subgenus *Microtus,* to which *M. sikkimensis* really belongs, while the similarity in the enamel pattern of the two species is very superficial.

Subgenus ANTELIOMYS[1] Miller.

New subgenus. Type *Microtus chinensis* Thomas.

Geographic distribution of type species.—*Microtus chinensis* is known from one specimen collected at Kiating-fu, west Sze-chuen, China.

---

[1] *Ἀντήλιος*, eastern; *μῦς*, mouse.

Geographic distribution of subgenus.—*Microtus chinensis* is the only known species of the subgenus.

Essential characters:

Palate abnormal.
$\overline{\text{m 3}}$ without closed triangles.
$\overline{\text{m 1}}$ with triangles mostly open, and with 9 salient angles.
$\underline{\text{m 3}}$ with triangles mostly open, and with 9 salient angles.
Mammæ, 4.
Plantar tubercles, 6.
Sole moderately hairy.
Claws on hind feet longest.
Fur not specially modified.

Skull.—As remarked by Mr. Thomas in the original description of *Microtus chinensis*, the skull of *Anteliomys* resembles in a general way that of *Evotomys*. Unfortunately, I am unable to add any more definite information concerning its characters.

Bony palate.—The palate of *Anteliomys* (Pl. II, fig. 8) is similar to that of *Eothenomys*, except that the median ridge is produced backward as a distinct spike lying perfectly in the plain of the roof of the mouth. Just in front of the strongly developed lateral bridges, the posterior edges of which form the back rim of the bony palate, lie two pits, in which terminate the lateral grooves. These pits communicate freely over (dorsad to) the lateral bridges with the anterior end of the broad mesopterygoid fossa.

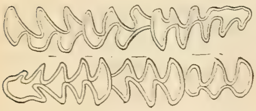


Fig. 23.—Enamel pattern of molar teeth, *Microtus* (*Anteliomys*) *chinensis*. (x 5.)

Enamel pattern in general.—The enamel pattern in *Anteliomys* (fig. 23) is characterized by rounded angles, imperfectly closed triangles, and great complexity in the prisms of the back upper molar.

Front lower molar.—The anterior lower molar is made up of four transverse, perfectly isolated loops. The anterior loop is much the largest and contains three salient angles (two on the inner side). Each of the succeeding loops has two salient angles. The tooth thus contains exactly the same elements as the corresponding one in *Microtus*, the difference in form being due to the fact that in *Anteliomys* the prisms are placed opposite each other instead of alternately. The prisms on the opposite sides of the tooth are nearly equal in size, thus producing the bilaterally symmetrical appearance found to a less degree developed in *Alticola* and *Eothenomys*. The figures in the original description of *Microtus chinensis*[1] give a very poor idea of the teeth.

Back upper molar.—The posterior maxillary tooth is like that of true *Microtus* except that the posterior loop is greatly lengthened and on the lingual side cut by two reentrant angles, of which the anterior is the deeper. There is a salient angle at the outer base of the posterior loop and the outer border is faintly crenulate. A tooth with nine well-developed salient angles is the result.

---

[1] Ann. & Mag. Nat. Hist., Ser. 6, Vol. VIII, p. 118, August, 1891.

Other teeth.—The front maxillary teeth are exactly as in tetramerodont *Microtus*. The back molars of the lower jaw are likewise in no way peculiar. They both, however, have the prisms on the two sides opposite, thus lacking all closed triangles.

There is nothing worthy of note in the form of the incisors.

Mammæ.—In the unique type specimen of *Microtus chinensis*, which is a female, there are four teats, all inguinal.

Feet.—The sole is well haired from heel to tubercles. There are six pads on the sole, all well developed.

Fur.—The fur is not specially modified.

General remarks.—In its palate structure *Anteliomys* is related to *Eothenomys*, and more remotely to *Alticola*, together with which it bridges the gap (so far as the palate alone is concerned) between *Microtus* and *Evotomys*. These facts were in part noticed by Mr. Thomas, who says in the original account of *M. chinensis :*

> In some respects it seems to be annectent between *Evotomys* and the rest of the voles, the structure of its palate and some of its dental characters [opposite prisms and rounded angles] showing striking affinities to the former, far as its rootless teeth, fewer mammæ, and different external form separate it from any of the known members of that group.

The enamel pattern is, however, very different from that of *Evotomys*, while the resemblance to that of its nearest relative, *Eothenomys*, is almost equally remote.

Microtus chinensis is the only species of *Anteliomys* thus far known, unless *Microtus middendorffii* (Polyakoff)[1] from Siberia[2] proves to be a member of the same group. The figure of the teeth in the original description of *M. middendorffii* is suggestive of *Microtus chinensis*, though the triangles are very strongly isolated. Neither the palate structure nor the number of mammæ is given by Polyakoff, so it is impossible to come to any conclusion on the subject of the animal's true status.

Subgenus LAGURUS Gloger.

1841. *Lagurus* Gloger, Gemeinn. Hand-u. Hilfsbuch d. Naturgesch., p. 97, 1841 (genus). Type, *Lagurus migratorius* Gloger = *Mus lagurus* Pallas?[3]

1895. *Lagurus* Merriam, Am. Naturalist, XXIX, p. 758, Aug., 1895 (subgenus).

---

[1] Mém. Acad. Imp. Sci., St. Pétersbourg, XXXIX suppl., p. 70, 1881.

[2] Polyakoff gives the following localities: Taimur, Vilui River, Ayan, and Kara River.

[3] In restoring the generic name *Lagurus* (Ann. & Mag. Nat. Hist., 6th ser., XV, Feb. 1, 1895) Mr. Thomas gives the species *lagurus* as the type. It appears highly probable, however, that Gloger's *Lagurus migratorius* is the *Hypudæus migratorius* of Lichtenstein (Eversmann's Reise nach Buchara, p. 123, 1823) = *Microtus* (*Lagurus*) *luteus* (Eversmann).

1881. *Eremiomys* Polyakoff, Mém. Acad. Imp. Sci., St. Pétersbourg, XXXIX suppl., p. 34, 1881 (genus). Type *Mus lagurus* Pall.

Geographic distribution of type species.—Plateaus of western and central Asia.

Geographic distribution of subgenus.—The range of the subgenus *Lagurus* is very imperfectly known, but probably extends over a large part of the Boreal region in Asia and in western North America.

Essential characters:

Palate slightly abnormal.
$\overline{\text{m 3}}$ normally with 2 or 3 tightly closed triangles.
$\overline{\text{m 1}}$ normally with 5 closed triangles and 8 or 9 salient angles.
$\underline{\text{m 3}}$ normally with 2 or 3 closed triangles and 5 or 6 salient angles.
Mammæ, 8.
Plantar tubercles, 5.
Sole very hairy.
Claws on hind feet longest.
Fur not specially modified.

Skull.—The skull of *Lagurus* (Pl. I, fig. 7[1]) may be at once recognized by the form of the audital bullæ (fig. 24). These are larger than in any other subgenus of *Microtus*, and are especially remarkable on account of the way in which they project backward behind the plane of the occiput. Aside from the audital bullæ, the skull does not differ very noticeably from that of *Pitymys* or *Chilotus*. As compared with that of *Pitymys*, however, the rostrum is considerably more slender. The dorsal outline is flat, as in *Chilotus*.

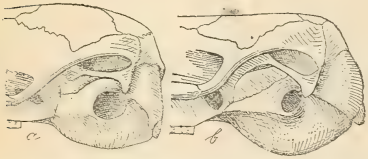


FIG. 24.—Audital bullæ, (*a*) *Microtus* (*Microtus*) *arvalis*; (*b*) *M.* (*Lagurus*) *pallidus*. (x 2.)

Bony palate.—The bony palate (Pl. II, fig. 2) is normal in structure but there is less difference than usual between the levels of the portions lying in front of and behind the lateral bridges. A peculiar flat palate with shallow lateral pits and broad, ill-defined median sloping ridge is the result. This form of palate is much like that of *Phenacomys* (Pl. II, fig. 1).

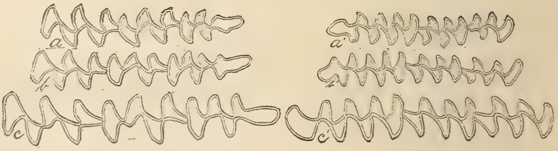


FIG. 25.—Enamel pattern of molar teeth: (*a*) *Microtus* (*Lagurus*) *pallidus*; (*b*) *M.* (*L.*) *lagurus*; (*c*) *M.* (*L.*) *luteus*. (x5.)

Enamel pattern in general.—The enamel pattern of *Lagurus* (fig. 25) is characterized by the tight closure of all triangles, notably in the back lower molar, and the great width of the reentrant angles. The latter peculiarity gives the teeth a drawn-out appearance, which is highly characteristic. Wide reentrant angles occur in the teeth of the young of all Microti; in *Lagurus* this embryonic character is retained by the adults.

---

[1] See also Naturwissenschaftliche Resultate der von N. M. Przewalski unternommenen Reisen, Pl. XIII, figs. 1, 2, 3, 12, 13, and 14.

Front lower molar.—The number of loops and triangles in the first mandibular tooth is the same as in true *Microtus*. In *Microtus przewalskii* and *Microtus luteus* the anterior loop is simple and much reduced, while in *Microtus lagurus* and *M. pallidus* the loop is exactly as in *Microtus arvalis.*

Back upper molar.—The posterior maxillary tooth differs considerably in form among the various species. In certain American species the loops and angles are arranged exactly as in *M.* (*Arvicola*) *terrestris*, while in *M. przewalskii* and *M. luteus* the tooth, although retaining the same number of elements, is remarkably like that of some of the species of *Alticola*. (See Pl. XIII, Wissensch. Resultate der von N. M. Przewalski nach Cent.-Asien untern. Reisen. Zool. Theil, Bd. I, Lief. 3.) This resemblance to *Alticola* results from the unusual elongation of the posterior loop. In *Microtus lagurus* there are three tightly closed triangles, and the terminal loop has a well developed salient angle on each side at the base.

Other teeth.—In the Old World species (fig. 25) the back lower molar contains four tightly closed triangles. The American species, however (fig. 25), so far as known, have only three closed triangles in this tooth. The other molars are always formed as in tetramerodont *Microtus*. There is nothing peculiar about the incisors.

Mammæ.—In *Microtus pallidus*, or a closely related form, there are eight mammæ, four pectoral and four inguinal. I have been able to find no statement of the number of mammæ in the Asiatic species.

Feet.—Soles densely hairy as in *Phaiomys* and the lemmings; plantar tubercles, five; claws moderately developed, those on hind feet longest.

Fur.—The fur is full and soft, but not highly modified. In color most of the species are dull yellowish or grayish. The marking of *Microtus lagurus* is unique in the genus *Microtus* on account of the strongly developed and sharply defined dark dorsal streak.

General remarks.—The subgenus *Lagurus* is a strongly characterized group, but, as Dr. Merriam has remarked,[1] the species show no peculiarities to separate them generically from *Microtus arvalis*. In *Microtus lagurus*, *M. luteus*, and *M. przewalskii*, the tail is usually shorter than the hind foot, thus adding to the superficial resemblance to the lemmings. No other voles have the tail so short.

The subgenus *Lagurus* is represented in the Old World by *Microtus lagurus* (Pallas), *M. luteus* (Eversmann), and *M. przewalskii* (Büchner). In America there are probably numerous species and subspecies. Among these may be mentioned *Microtus pauperrimus* (Cooper), *M. curtatus* (Cope), and *M. pallidus* (Merriam).

---

[1] American Naturalist, XXIX, p. 758, August, 1895.

Subgenus ALTICOLA Blanford.

1884. *Alticola* Blanford, Journ. Asiat. Soc. Bengal, L, Pt. II, p. 89, 1884. Type *Arvicola stoliczkanus* Blanford.

Geographic distribution of type species.—"High plateaus of Northern Ladák (Western Tibet)" (Blanford).

Geographic distribution of subgenus.—Boreal Zone in the Himalayas.

Essential characters:

Palate abnormal.
$\overline{\text{m 3}}$ without closed triangles.
$\overline{\text{m 1}}$ with 4 or 5 closed triangles and 7 salient angles.
$\underline{\text{m 3}}$ normally with 2 closed triangles and 5 or 6 salient angles; posterior loop produced backward in line of jaw.
Mammæ, 8.
Plantar tubercles, 6.
Sole, hairy.
Claws on hind feet longest.
Fur long and soft but not highly modified.

Skull.—The skull in this subgenus (Pl. I, fig. 10) shows no striking peculiarities to distinguish it from that of true *Microtus*. The general shape is usually much as in *Microtus arvalis*, but the zygomatic arches are more flaring and the brain case is somewhat broader and flatter. The rostrum is proportionally longer than in *Microtus* proper, and the audital bullæ (fig. 27) are more inflated and papery.

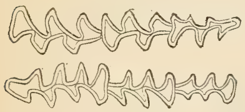


FIG. 26.—Enamel pattern of molar teeth, *Microtus* (*Alticola*) *albicauda* (type). (× 5.)

Bony palate.—The median palatal ridge (Pl. II, fig. 4) widens at a point opposite the space between the second and third molars and is approached, as in the typical microtine palate, by outgrowths from the opposite sides of the lateral grooves. These outgrowths, however, do not meet the median ridge, but leave the lateral grooves open. Just at its widest point the median ridge is squarely truncated. The sloping terminal ridge is entirely lacking and the space that it usually occupies forms the anterior end of the very long rectangular interpterygoid fossa. A structure of much the same appearance could be produced by widening the anterior end of such a hastate interpterygoid fossa as that often present in '*Aulacomys*' (Pl. II, fig. 7) until the whole space acquired an equal breadth. The floors and median walls of the lateral pits would then be so encroached upon as to obliterate the pits, while a few slight further modifications would give a palate indistinguishable from that of *Alticola*. The palate of *Alticola* resembles that of *Neofiber* more closely than it does that of any other subgenera except *Hyperacrius*.

Enamel pattern in general.—The enamel pattern in *Alticola* (fig. 26) differs in many ways from that of any subgenus of *Microtus*. In general it is characterized by (*a*) a tendency to reduction in the number of prisms in the variable teeth; (*b*) by a peculiar irregularity and indefiniteness in outline; (*c*) by a strong tendency toward bilateral symmetry caused by the approximately equal size of the triangles on the opposite sides of the teeth, and (*d*) by the form of the posterior upper molar.

While the figures published by Blanford[1] in his paper on the voles of the Himalayas, Tibet, and Afghanistan are in many ways inaccurate, they give an excellent idea of the general appearance of the teeth in the voles of this group.

Front lower molar.—The first mandibular molar has normally four closed triangles and seven or eight salient angles. Rarely a fifth closed triangle is isolated at the inner basal angle of the anterior loop. The form, relative position, and degree of isolation of the triangles and transverse loops vary greatly with the different species. Any one of the reentrant enamel folds may fail to reach the enamel of the opposite side, and consequently any of the triangles may be open at one or both ends.

Back upper molar.—The posterior maxillary tooth varies in form in the different species. It is, however, always recognizable by the backward prolongation of the posterior loop in the line of the jaw, a character which is found elsewhere in *Hyperacrius*, *Chilotus*, and *Lagurus* only, and in all but the first of these developed to a much less degree. This attenuate posterior loop is followed by three or four more or less incompletely isolated lateral triangles, these by an anterior loop of the usual form. The tooth is most complex in *M. roylei* and *M. blanfordi*, in each of which it has six salient angles and two or three closed triangles.

Other teeth.—Except for the stronger tendency to bilateral symmetry combined with slight irregularity of outline the other molars do not differ from those of ordinary tetramerodont *Microtus*.

Mammæ.—The number of mammæ in the species of *Alticola* has apparently not been recorded. Blanford does not mention it in his descriptions of any of the species, and Mr. G. E. H. Barrett-Hamilton, who has made at my request a special examination of the material in the British Museum, is able to add nothing on the subject. In an adult nursing female of a species of *Alticola* closely allied to *Microtus albicauda* (No. 62162, U. S. Nat. Mus. Ladák side of Kara Korum Pass, Kashmir) there are eight well-developed mammæ. Hence there is little doubt that eight is the normal number in the subgenus.

Feet.—The feet are very hairy, the long hairs on the dorsal surface often nearly concealing the claws. Plantar tubercles six. The claws on all the feet are long and slender, those on the hind feet longer than those in front.

Fur.—As in most high boreal microtines the fur is long and full. Otherwise it is not peculiar.

General remarks.—The subgenus *Alticola* is one of the best characterized groups in the genus *Microtus*. The pattern of enamel folding is unlike that of any of the other subgenera, except *Hyperacrius*, while the palate structure is approached by that of *Hyperacrius* and the otherwise widely different *Neofiber* only. The tendency to bilateral symmetry in the molars is shared by three other Asiatic subgenera, *Hyperacrius*, *Eothenomys*, and *Anteliomys*.

---

[1] Journ. Asiatic Soc. Bengal, L, Pt. II, Pl. I, figs. B, C, D, and E.

Alticola, like *Hyperacrius*, is apparently a strictly boreal subgenus. The following species are known: *Microtus stoliczkanus* Blanford, *M. roylii* (Gray), *M. stracheyi* (Thomas), *M. blanfordi* (Scully), and *M. albicauda* (True).

Subgenus HYPERACRIUS[1] Miller.

New subgenus. Type *Arvicola fertilis* True.

Geographic distribution of type species.—"Central Kashmir, the Pir Panjal Range and the Kaj Nag Mountains." (True.)

Geographic distribution of subgenus.—Mountains of central and southwestern Kashmir at elevations ranging mostly from 7,000 to 12,000 feet.

Essential characters:

Palate abnormal.
$\overline{\text{m 3}}$ without closed triangles.
$\overline{\text{m 1}}$ normally with 4 or 5 closed triangles and 7 salient angles.
$\underline{\text{m 3}}$ normally with 1 or 2 closed triangles and 4 salient angles.
Mammæ 4.
Plantar tubercles 5.
Sole hairy.
Claws on hind feet longest.
Fur short and dense.

Skull.—The skull in the subgenus *Hyperacrius* (Pl. I, fig. 11) differs from that of *Alticola* in its longer rostrum, strongly cuneate nasals, narrower interorbital constriction, more abruptly flaring zygomata, and flatter brain case. The whole dorsal outline of the skull is depressed so that the zygomata are more nearly on the level with the top of the skull than in any other subgenus of *Microtus*. The audital bullæ (fig. 27) are proportionally smaller than in *Alticola*, true *Microtus*, or *Pitymys*. The brain case is much more depressed than in *Microtus* proper (flatter even than in *Pitymys*), and viewed from above it has a peculiar subcircular outline not known elsewhere in the genus. Parietals proportionally smaller than in *Microtus* proper; squamosals and interparietal proportionally larger. The latter in old individuals has much the same shape as in fully adult *Arvicola*, *Neofiber*, and *Fiber*.

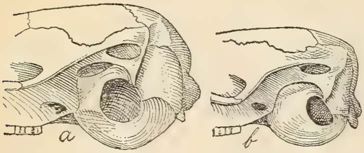


FIG. 27.—Audital bullæ, (*a*) *Microtus* (*Alticola*) *albicauda*; (*b*) *M.* (*Hyperacrius*) *fertilis*. (x 2.)

Bony palate.—The bony palate is exactly as in *Alticola*.

Enamel pattern in general.—The enamel pattern (fig. 28) has the general appearance of that of *Alticola*.

Front lower molar.—The first mandibular tooth is indistinguishable from the corresponding tooth in *Alticola*.

---

[1] *Οἱ ὑπεράκριοι*, inhabitants of the heights.

Back upper molar.—The last maxillary tooth has the same general form as that of *Alticola*, but is simpler in structure, thus recalling the corresponding tooth in *Lagurus* (fig. 25). There are usually only two lateral triangles and four salient angles. The posterior loop is lengthened in the axis of the jaw as in *Alticola*.

Mammæ.—There are four mammæ, all inguinal.

Feet.—The feet are well haired, but rather less densely than in *Alticola*. Plantar tubercles five—the faintest possible trace of a sixth sometimes present. Claws on all four feet well developed, those on hind feet longest.

Fur.—The fur is much shorter and more dense than in *Alticola*.

Miscellaneous characters.—The ears, and apparently the eyes, also, are smaller than in *Alticola*. The whiskers are very short, reaching scarcely to the ears, while in *Alticola* they are probably longer than in any other subgenus of *Microtus*.

General remarks.—*Hyperacrius* is most closely related to *Alticola*, from which it differs chiefly in its highly modified skull and reduced number of footpads and mammæ. Minor differences are to be found in the relative size of the ears and in the character of the feet. *Hyperacrius* appears to be modified for a more strictly underground life than *Alticola*. It requires no close comparison with any other subgenus, though it bears a superficial likeness both in external form and in cranial characters to *Pitymys*. The structure of the bony palate and the pattern of enamel folding readily distinguish it from the latter, however.

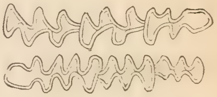


FIG. 28.—Enamel pattern of molar teeth, *Microtus* (*Hyperacrius*) *fertilis*. (x 5.)

Whether *Microtus wynnei* may be associated with *Microtus fertilis* in the subgenus *Hyperacrius* is a matter of doubt. At my request Mr. G. E. H. Barrett-Hamilton has examined the specimens of *Alticola* in the British Museum with special reference to the relationships of *M. wynnei*. He finds that this species, as already noticed by Blanford, has only five plantar tubercles, but that in other characters it does not agree with the brief diagnosis of *Hyperacrius* that I sent him. The fur is long, as in the species of *Alticola*, and the skull apparently lacks the peculiar form seen in *Hyperacrius*. The number of mammæ can not be determined in *M. wynnei* nor in any of the species of *Alticola* in the British Museum. For the present it is not safe to attempt to refer *Microtus wynnei* definitely to one subgenus or the other.

Subgenus PEDOMYS Baird.

1857. *Pedomys* Baird, Mamm. N. A., p. 517, 1857. Type *Arvicola austerus* LeConte.

Geographic distribution of type species.—Transition and Upper Austral zones in the central United States and adjoining British Provinces.

Geographic distribution of subgenus.—The range of this subgenus is the same as that of *Microtus austerus*, the only known species.

Essential characters:

Palate normal.
$\overline{\text{m 3}}$ without closed triangles.

$\overline{\text{m}}$ 1 normally with 3 closed triangles and 8 or 9 salient angles.
m 3 normally with 2 closed triangles and 6 salient angles.
Mammæ 4.
Plantar tubercles 5.
Sole thickly haired between heel and tubercles.
Claws moderate in length, those on hind foot longest.
Fur not specially modified.

Skull.—The skull of *Microtus austerus*, the only known species of *Pedomys*, is remarkable for the subcylindric brain case, and great depth of all that part back of the rostrum. While the skull of *Pedomys* is not strikingly different from that of true *Microtus*,[1] it is very unlike the flattened skulls of *Phaiomys*, *Pitymys*, and *Chilotus*, the other groups of small voles resembling *Pedomys* in tooth characters and in number of mammæ and footpads.

Bony palate.—The bony palate is typical, though the interpterygoid fossa is seldom squarely truncate anteriorly.

Enamel pattern in general.—The enamel pattern (fig. 29) is characterized by simplification in the structure of the variable teeth.

Front lower molar.—The first mandibular molar has a posterior transverse loop followed by three closed triangles and an anterior loop. The anterior loop is deeply indented by two reentrant angles, one on each side. These sometimes cut deep enough to isolate a fourth or even a fifth closed triangle, but this rarely takes place. There is often a very faintly developed reentrant angle close to each side of the tip of the anterior loop. In cases where these are strongly marked a front tooth precisely resembling that of *Microtus* is the result.

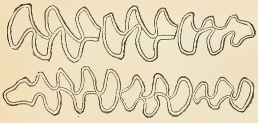


Fig. 29.—Enamel pattern of molar teeth, *Microtus* (*Pedomys*) *austerus*. (x 5.)

Back upper molar.—The posterior maxillary tooth is exactly like that of *Neofiber*, *Pitymys*, *Phaiomys*, *Chilotus*, and typical *Arvicola*, having an anterior transverse loop, two closed triangles and a short posterior loop, from the outer base of which a third closed triangle may sometimes be cut.

Other teeth.—With the exception of the two teeth just described, the dentition of *Pedomys* is like that of the tetramerodont species of the subgenus *Microtus*.

Mammæ.—There are four mammæ, all inguinal.

Feet.—Soles densely hairy between heel and tubercles; pads five, with no indication of a rudimentary sixth.

General remarks.—*Pedomys* agrees in tooth pattern with *Pitymys*, *Chilotus*, and *Phaiomys*, but differs from all three in the shape of the skull, and from the last in the short claws and unmodified fur also.

Subgenus PHAIOMYS Blyth.

1863. *Phaiomys* Blyth, Journ. Asiat. Soc. Bengal, XXXII, p. 89, 1863. Type *Phaiomys leucurus* Blyth=*Microtus blythi* Blandford.

---

[1] A skull of *Microtus ratticeps* from Norway exactly resembles skulls of *M. austerus* except that the rostrum is more slender.

1887. *Lasiopodomys* Lataste, Annali del Mus. Civ. di Storia Naturale di Genova, ser. 2a, Vol. IV, p. 268, 1887. Type *Arvicola branti* Radde.

Geographic distribution of type species.—"Banks of Tsho Morari and Pankong lakes, Western Tibet, also between Seh and the Pankong Lake at elevations above 13,000 feet." (Blanford.)

Geographic distribution of subgenus.—High plateau region of central and southern Asia. Probably does not occur below the Boreal zone.

Essential characters:

Palate normal.
m 3 without closed triangles.
m 1 normally with 3 to 5 closed triangles and 8 or 9 salient angles.
m 3 normally with 2 to 3 closed triangles and 6 salient angles.
Mammæ probably 10.
Plantar tubercles, 6.
Sole very hairy.
Claws very long and of about equal length on all four feet.
Fur remarkably long and soft.

Skull.—The skull of *Phaiomys* as compared with that of *Pedomys* is readily distinguished by its very different form. The brain case in *Pedomys* is high, long, and almost cylindrical, while that of *Phaiomys* is short, broad, and flat. The zygomatic arches are more broadly flaring in *Phaiomys* than in *Pedomys*, while the upper incisors are usually more prominent. The latter character is, however, inconstant.

Bony palate.—The bony palate is perfectly normal and requires no detailed description.

Enamel pattern in general.—The enamel pattern (fig. 30) is exactly like that of *Pedomys*, except that the outer reentrant angles in m 3 are somewhat less developed, while the anterior outer reentrant angle in m 2 usually divides the anterior loop into two closed triangles. These differences, however, are trivial and inconstant.

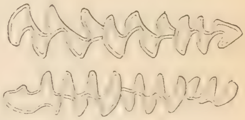


FIG. 30.—Enamel pattern of molar teeth, *Microtus* (*Phaiomys*) *strauchi*. (x 5.)

Other teeth.—In some of the members of the subgenus the incisors are directed more forward than usual. The character is, as already stated, wholly inconstant.

Mammæ.—There is still doubt as to the normal number of mammæ in the subgenus *Phaiomys*. Milne-Edwards found only four in a skin of *M. mandrianus*; Büchner found six in a skin of *M. strauchi*, and ten in a skin of *M. fuscus*. I am inclined to think that ten will prove to be the correct number.[1] In the specimen of *M. fuscus* just referred to there were six pectoral mammæ, the rest inguinal.

Feet.—The feet are large and densely haired. The number of tubercles on the sole is still a matter of doubt. Büchner records six in both

---

[1] That *Phaiomys* probably has a large number of mammæ—at least more than four—was suspected by Lataste, who in 1887 (Annali del Museo Civico di Storia Naturale di Genova, Serie 2a, Vol. IV, p. 270) called attention to the fact that Blyth found ten embryos in a female *Microtus blythi*.

M. brandti and *M. strauchi*, but I am able to find only five in a skin of the latter, even after thoroughly relaxing the foot. It is probable that six is the real number, as Büchner's determinations were made from alcoholic specimens. The claws on all four feet are large and about equal in length. That on the thumb is well developed—in this respect perhaps surpassing all other subgenera of *Microtus*.

Fur.—The fur is long and soft, suggesting that of a lemming rather than that of a vole.

General remarks.—In many respects *Phaiomys* resembles *Pedomys* so closely that I should hesitate to separate the two groups were they not already named. There are, however, such differences between them that it is impossible to call them the same, while in all probability more satisfactory material than that now available would show additional characters. In external appearance the two subgenera differ considerably. While *Pedomys* is a typical vole, *Phaiomys* bears a general resemblance to the lemmings. The peculiar aspect of the species of *Phaiomys* is caused by their short tails, large feet, and long, soft fur. The likeness between the species of *Phaiomys* and the yellowish species of the subgenus *Lagurus* is even more striking. From the latter, however, they are readily separable by dental characters.

Microtus blythi (Blanford), *M. mandarinus* (Milne-Edwards), *M. strauchi* Büchner, *M. fuscus* (Büchner), and *M. brandti* (Radde), are perhaps the best-known species of the subgenus *Phaiomys*.

Subgenus PITYMYS McMurtrie.

1830. *Psammomys* LeConte, Ann. Lyc. Nat. Hist., New York, III, p. 132, 1830 (genus). Type *Psammomys pinetorum* Le Conte (not *Psammomys* Cretzschmar 1828).

1831. *Pitymys* McMurtrie, American edition, Cuvier Règne Animal, I, p. 434, 1831 (genus). Type *Psammomys pinetorum* LeConte.

1857. *Pitymys* Baird, Mamm. N. Am., p. 517, 1857 (section)

1887. *Pitymys* Lataste, Annali del Mus. Civ. di Storia Naturale di Genova, serie 2*a*, IV, p. 266, 1887 (subgenus).

1831. *Ammomys* Bonaparte, Saggio Distrib. Metod. degli Anim. Vert., p. 20, footnote, 1831 (genus). Type *Psammomys pinetorum* Le Conte.

1836. *Pinemys* Lesson, Hist. Nat. d. Mamm. et Ois découv. depuis 1788, Compl. Oeuvres de Buffon, V, p. 436, 1836 (genus). Type *Psammomys pinetorum* LeConte.

1867. *Terricola* Fatio, Les Campagnols du Bassin du Léman, p. 36, 1867 (subgenus) (*subterraneus* and *savii*).

1876. *Micrurus* Forsyth Major, Atti della Società Toscana di Sci. Nat., III, fasc. I, p. 126, 1876 (subgenus). Type *Arvicola nebrodensis* Mina Palumbo.

Geographic distribution of type species.—Austral Zone in the eastern United States.

Geographic distribution of subgenus.—Central and southern Europe, eastern United States, parts of Mexico.

Essential characters:

Palate, normal.

$\overline{\text{m 3}}$ without closed triangles.

$\overline{\text{m 1}}$ normally with 5 closed triangles and 9 salient angles.

m 3 normally with 2 or 3 closed triangles and 6 salient angles.
Mammæ, 4.
Plantar tubercles, 5.
Sole moderately hairy.
Claws on front feet longest.
Fur short, dense, and mole like.

Skull.—The skulls of the species of *Pitymys* differ considerably among themselves. In *Microtus pinetorum* (Pl. I, fig. 2), the most highly modified, the brain case is very broad and flat and the interorbital region is remarkably wide. The brain case is like that of *Lagurus*, but the broad anterior part of the skull is very different from the latter. The dorsal outline is strongly arched, especially anteriorly from the region between the orbits to the tips of the nasals. The arching is, however, no more strongly marked than in *Microtus arvalis.* In *Microtus subterraneus* the skull is like that of *M. pinetorum*, but the peculiarities are less accentuated. In the Mexican species of *Pitymys* the brain case is narrower and higher than in *M. pinetorum*, and the anterior part of the skull is less heavily built. The zygomatic processes of the maxillæ stand out more nearly at right angles with the side of the skull, thus bringing the broadest part of the zygomatic arch farther forward than in *M. pinetorum.*

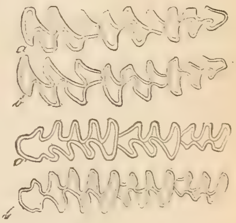


Fig. 31.—Enamel pattern of molar teeth, (*a*) *Microtus* (*Pitymys*) *pinetorum*; (*b*) *M.* (*P.*) *savii.* (x 5.)

Bony palate.—The palate is normal, though the region between the posterior molars is in *M. pinetorum* rather flatter than usual in true *Microtus*, and the anterior outline of the interpterygoid fossa is often somewhat hastate.

Enamel pattern in general.—With the exception of the front lower molar and back upper molar, the enamel pattern (fig. 31) is that of tetramerodont *Microtus.*

Front lower molar.—The anterior mandibular tooth contains the same number of loops and angles as the corresponding tooth in *Microtus arvalis.* As a rule, however, the first and second triangles are not completely isolated from each other or from the anterior loop. The tooth is therefore exactly as in *Pedomys.*

Back upper molar.—The posterior maxillary tooth is simplest in the American species of the subgenus. In these it is like the back upper tooth in *Pedomys* and *Arvicola*, which contain two closed triangles and an anterior and posterior loop. In *M. subterraneus*, however, the tooth is formed exactly as in *M. arvalis*, while in *M. savii* it is somewhat intermediate. In the last-named species the terminal loop is slightly larger than in *M. pinetorum*, and a third closed triangle is usually cut off from the outer base.

Other teeth.—There is nothing peculiar about the incisors or remaining molars.

Mammæ.—In *Pitymys* there are only four mammæ—all inguinal.

Feet.—The soles are moderately hairy. They have five well-developed tubercles, but no trace of a sixth. The claws are well developed on all the feet, those on the front feet either equaling or exceeding those on the hind feet.

In *M. pinetorum* the front feet are much larger and the front legs shorter than in true *Microtus.* These peculiarities are less developed in *M. subterraneus* and *M. savii.* Of the other species I have not seen alcoholic specimens, and so am unable to say which of those mentioned they most closely resemble.

Fur.—The fur in all the known species is remarkably short and dense. This character is most noticeable in *M. pinetorum*, which has an almost mole-like coat.

Miscellaneous characters.—The tail, eyes, and external ears are much reduced in all the species of *Pitymys.* These characters, as well as the peculiarities of the fur and front feet, are distinctly adaptive and fit the animals for their underground life.

General remarks.—While *Pitymys* agrees with *Pedomys* in the number of mammæ and footpads, it is readily distinguished by its highly modified fur, small eyes and ears, and flattened skull. The type and most extremely developed species is further characterized by its greatly shortened front legs.

Pitymys is represented in America by *Microtus pinetorum* (Le Conte) and several forms related to *M. quasiater* (Coues). In Europe a number of species and subspecies occur. Among these the best known are *M. subterraneus* (De Sélys Longchamps) and *M. savii* (De Sélys Longchamps).

Subgenus CHILOTUS Baird.

1857. *Chilotus* Baird, Mamm. N. Am., p. 516, 1857. Type, *Arvicola oregoni* Bachman.

Geographic distribution of type species.—Oregon, Washington, and British Columbia.

Geographic distribution of subgenus.—The range of the subgenus *Chilotus* is coincident with that of the type and only known species.

Essential characters:

Palate normal.
$\overline{\text{m 3}}$ normally without closed triangles.
$\overline{\text{m 1}}$ with 5 closed triangles and 9 or 10 salient angles.
$\underline{\text{m 3}}$ with 2 or 3 closed triangles and 6 salient angles.
Mammæ 8.
Plantar tubercles 5.
Sole moderately hairy.
Claws on hind feet longest.
Fur short and dense.

Skull.—The skull of *Chilotus* (Pl. I, fig. 8) is low and flat, the dorsal outline nearly straight, and the brain case not widened, as in *Pedomys.* As compared with *Pedomys*, the rostrum is remarkably long and slender in proportion to the rest of the skull.

Bony palate.—The palate is normal and calls for no further remark.

Enamel pattern in general.—The enamel folding (fig. 32) is like that of the tetramerodont species of *Microtus*, except that the back upper tooth is a little simplified.

Front lower molar.—The first mandibular molar is exactly like that of typical *Microtus*.

Back upper molar.—The back maxillary tooth contains a transverse anterior loop, two lateral closed triangles, and a somewhat lengthened terminal loop. The latter has at each side of its base a conspicuous angle, the outer one of which is often isolated as a third closed triangle. The tooth has six salient angles, two to each of the transverse loops and one to each of the closed triangles.

Other teeth.—As already stated, the remaining teeth are formed exactly as in tetramerodont *Microtus*. One specimen from British Columbia has the lateral triangles closed in the back lower molar.

Mammæ.—There are eight mammæ, four pectoral and four inguinal.

Feet.—Soles moderately hairy from heel to tubercles; plantar tubercles five, all well developed; claws on hind feet longest; front feet not modified like those of typical *Pitymys*.

Fur.—The fur is shorter and more dense than in true *Microtus*, but the modification is not carried so far as in *Microtus* (*Pitymys*) *pinetorum*.

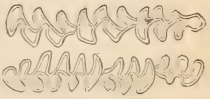


FIG. 32.—Enamel pattern of molar teeth. *Microtus* (*Chilotus*) *oregoni*. (x 5.)

General remarks.—*Chilotus* combines the mammæ and foot pads of *Arvicola* with the nearly typical enamel pattern of *Microtus* and has a form of skull peculiarly its own. In general it is modified in the same direction as *Pitymys*, but to a much less degree.

Great stress has been laid on the form of the ear as a character of this subgenus. In the original description[1] Baird says:

> A specimen in alcohol, from Steilacoom, received since the preceding description was prepared, is, in size, much as described. The ears are low. orbicular, the membrane thickened, the margins or conchal portion much inflected or incurved, like a half-open apple blossom, the concha being inflected all round. The antitragus is well developed, but rather low. The surfaces of the ear appear perfectly naked, with, however, a ciliation of long hairs toward the roots of the concha, on the dorsal surface. A close examination of the auricle in the dried specimen shows a few scattered, very short, white hairs.
>
> The structure of the ear, though in many respects similar to that of *A. pinetorum*, is yet essentially different. Thus the upper and lower roots of the margin of the ear meet anteriorly so as to form even a low rim to the meatus anteriorly, completely inclosing the aperture; the edge of the concha is inflected; the region inside the auricle, around the meatus, naked, and the antitragus so much developed as to be capable of completely closing the meatus. In *A. pinetorum* the roots of the upper and lower margins of the ear are widely separated, by a space of a quarter of an inch, the space between these roots and anterior to the meatus perfectly plane; the edges of the concha, or of the auricle, not inflected at all; the inner space around the meatus partly hairy; the antitragus very slightly developed, not valvular, nor capable of closing the meatus at all.

---

[1] Mamm. N. Am., p. 538, 1857.

Through Mr. True's kindness I have been able to examine one of the alcoholic specimens on which Baird based this description. This specimen (No. 2533, from Tomales Bay, Cal.[1]) is in good condition and shows most of the peculiarities to which attention was called. The thickening of the edge of the auricle is, however, due to disease or to the action of the parasites which often attack the rims of the ears in the voles and other small rodents. The anterior base of the ear is not essentially different from the same region in *Pitymys*, though the valvular fold is slightly more developed. It is probable that by means of this fold the meatus in *Pitymys*, as well as in most if not all of the voles, can be tightly closed.

Subgenus MICROTUS Schrank.

1798. *Microtus* Schrank, Fauna Boica, I, 1ste Abth., p. 72, 1798. Type by elimination *Microtus terrestris* Schrank = *Mus arvalis* Pall.

1817. *Mynomes* Rafinesque, Am. Monthly Magazine, II, p. 45, 1817. Type *Mynomes pratensis* Raf. = *Arvicola pennsylvanicus* Ord.

1836. *Hemiotomys* DeSélys Longchamps, Essai Monographique sur les Campagnols des environs de Liège, p. 7, 1836, part (included *arvalis* and *terrestris*).

1857. *Hemiotomys* Baird, Mamm. N. Am., p. 515, 1857.

1849. *Neodon* Hodgson, Ann. and Mag. Nat. Hist., 2d ser., III, p. 203, 1849. Type *Neodon sikkimensis* Hodgson.

1857. *Paludicola* Blasius, Fauna der Wirbelthiere Deutschlands, I, p. 333, 1857, part (included *terrestris, nivalis,* and *ratticeps*).

1857. *Agricola* Blasius, Fauna der Wirbelthiere Deutschlands, I, p. 334, 1857. Type *Arvicola agrestis.*

1867. *Praticola* Fatio, Les Campagnols du Bassin du Léman, p. 36, 1867, part (included *terrestris, nivalis, arvalis, ratticeps,* and *campestris*).

1867. *Sylvicola* Fatio, Les Campagnols du Bassin du Léman, p. 63, 1867. Type *Arvicola agrestis.*

1890. *Campicola* Schulze, Schriften Naturwiss. Vereins d. Harzes in Wernigerode, V, p. 24, 1890, part (included *arvalis, subterraneus,* and *campestris*).

1894. *Tetramerodon* Rhoads, Proc. Acad. Nat. Sci. Phila., p. 282, 1894. Type *Arvicola tetramerus* Rhoads.

Geographic distribution of type species.—Central Europe.

Geographic distribution of subgenus.—Boreal region of both hemispheres, south to Mexico, northern India, and southern Europe.

Essential characters:

Palate normal.

$\overline{\text{m 3}}$ without closed triangles.

$\overline{\text{m 1}}$ normally with 5 closed triangles and 9 salient angles.
$\underline{\text{m 3}}$ normally with 3 closed triangles and 7 or 8 salient angles.

Mammæ, 8.
Plantar tubercles, 6.
Sole moderately hairy.
Claws of hind feet longest.
Fur not specially modified.

Skull.—In true *Microtus* (Pl. I, fig. 3) the skull lacks the peculiar modifications found in such subgenera as *Lagurus*, *Pitymys*, *Chilotus*, and others. Within certain limits, however, the skull varies considerably in size and form, so that it is difficult to frame any accurate diagnosis. The skull of *Microtus arvalis* figured on Plate I represents the form characteristic of the great majority of species. One of the most notable departures from this type is seen in the skull of *Microtus nivalis*, which has an unusually low, broad brain case, and flat dorsal outline.

---

[1] No. 2529 from Steilacoom, Wash., also mentioned by Baird, is lost.

Bony palate.—The bony palate in the subgenus *Microtus* (fig. 7 A, and Pl. II, fig. 5) shows in its most perfect development the form which may be considered the normal one in the genus, since it is characteristic of most of the subgenera and of the vast majority of species. As this palate has already been described (pp. 26–27) it is necessary here to notice a few departures from the type form only. In young individuals the sloping ridge is broader than in the adults, while in very old individuals it often becomes very abrupt and at the same time greatly narrowed. These two extremes, which are usually characteristic of immaturity and old age, occur as the normal condition in the adults of certain species. In *Microtus nivalis* the ridge is broad and flat, while in *M. agrestis*, *M. ratticeps*, and most of the American species it is narrow and abrupt. Occasionally (especially in *M. agrestis* and *M. ratticeps*) the anterior edge of the interpterygoid fossa is encroached upon by the projecting median ridge. The latter, on the other hand, may be slightly cleft in the median line, thus foreshadowing the first step in the series of changes which lead to the very different palate of *Evotomys*.

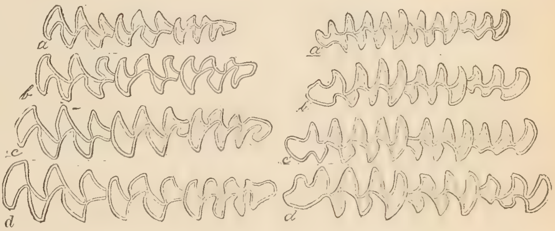


FIG. 33.—Enamel pattern of molar teeth, (*a*) *Microtus* (*Microtus*) *arvalis*; (*b*) *M.* (*M.*) *nivalis*; (*c*) *M.* (*M.*) *pennsylvanicus*; (*d*) *M.* (*M.*) *ratticeps*. (x 5.)

Enamel pattern in general.—The enamel pattern in the subgenus *Microtus* (fig. 33) is characterized by the large number of loops and angles in the first lower molar and last upper molar.

Front lower molar.—The first lower molar normally contains a posterior transverse loop, five closed triangles, two of which are on the outer side and three on the inner side, and finally an anterior loop which is usually more or less deeply cut by two reentrant angles, one on each side of the loop, the outer of which is always the more posterior of the two. With these loops and triangles are usually associated nine well-developed salient angles, two formed by the posterior transverse loop, one by each of the five closed triangles, and one by each side of the base of the anterior loop. That part of the anterior loop which lies in front of the reentrant angles may develop a salient angle on its inner side, less frequently one on the outer side. Very rarely the loop may be cut by a third reentrant angle. This condition occurs in adult specimens of *Microtus agrestis*, *M. pennsylvanicus*, also in the type of *M.* (*Arvicola*) *arvicoloides* (fig. 35), and probably in any other species with the tooth formed after the pattern of *Microtus arvalis*. The other variations in the form of the front lower molar are the result of the greater or less development of the reentrant angles normally present at the anterior end. Sometimes the fourth reentrant angle (counting from behind) on the lingual side of the tooth fails to meet the third on the opposite side. Very rarely the anterior outer triangle opens in a like manner into the anterior inner triangle, and the latter at the same time communicates with the anterior loop, thus producing a tooth like that normally present in *Pedomys* and *Pitymys*. Rather frequently a sixth closed triangle is cut off from the outer basal corner of the anterior loop, and occasionally a seventh triangle is isolated at the inner side of the greatly reduced loop.

The variations just described are purely individual and occur in the species having the tooth of the typical form. Two notable variations from this form are normally found in *Microtus ratticeps* and *M. nivalis*. In the former (fig. 33*d*) the fifth triangle opens into the short, unindented anterior loop. There is here an actual reduction in the elements of the ooth, which has only eight salient angles, thus resembling the corresponding tooth in *Pedomys*. In *M. nivalis* (fig. 33*b*), while there are five closed triangles and nine salient angles, the anterior loop is small and crescentic, much resembling the posterior loop in the maxillary teeth of *Eothenomys*.

Back upper molar.—The last upper molar is normally made up as follows: An anterior transverse loop, succeeded by three closed triangles, two smaller ones on the outer side and a larger one on the inner side, these in turn by a posterior loop of variable shape. The tooth usually contains seven salient angles, two to each of the transverse loops and one to each of the three closed triangles.

Variations in the form of this tooth are numerous. Beginning at the anterior end where the structure is most definite, it is found that the first outer triangle very frequently opens into the large inner triangle, less often into the anterior loop. The second outer triangle very rarely opens into the inner triangle, but is rather frequently in communication with the posterior loop. The posterior loop varies in form and size, the variations being partly individual and partly characteristic of species. For the present it is unnecessary to discriminate in all cases between the two categories. The most usual form and that found in the type species, *Microtus arvalis* (fig. 33*a*) is an irregular crescent with the concavity directed inward and backward and the posterior tip thickened, the whole joined to the rest of the tooth at a point on the convexity midway between the middle and the anterior extremity. This nearly crescentic form is usually distorted by the elongation and straightening of the anterior limb, so that the resulting shape is more like that of the letter J. The thickened posterior extremity of the loop is often extended and cut by a reentrant angle on the lingual side, so that the crescent is modified into the form of a rude E. Occasionally the anterior extremity of the crescent is isolated as a second inner triangle. The convex side of the crescent may develop a more or less prominent salient angle. This condition is normal in *Microtus ratticeps* and *Microtus chrotorrhinus*, but occurs also in other species. In the aberrant *Microtus nivalis* the structure of this tooth is simplified so that it is essentially as in *Arvicola*, *Pedomys*, and *Pitymys*.

Other teeth.—The first and second upper molars contain each an anterior transverse loop and, respectively, ~~three~~ and ~~two~~ closed triangles. In *Microtus agrestis*, *M. sikkimensis*, *M. pennsylvanicus*, *M. terrænovæ*, and *M. aztecus* the inner edge of m 2 is produced into a conspicuous loop, which frequently becomes isolated, so as to form a closed triangle about half the size of the others. The European species with m 2 formed in this way have been placed in a subgenus called *Agricola* or *Sylvicola*, while the American species have been referred to *Mynomes* in a restricted sense. The American species with m 2 exactly as in *Microtus arvalis* have received the name *Tetramerodon*. While the name *Tetramerodon* can not be used in a subgeneric sense, it is frequently convenient to speak of the voles with the enamel pattern of *M. arvalis* as the tetramerodont species to distinguish them from their pentamerodont allies. In *Microtus sikkimensis* a supplemental triangle is developed in m 1 as well as in m 2. On account of this peculiarity the animal has been made the type of the genus or subgenus '*Neodon*.' Neither *Neodon* nor *Agricola* are worthy of recognition as subgenera distinct from *Microtus*. Their characters are of trifling importance, while in other species of *Microtus* (as, for instance, *M. nivalis*, *M. guentheri*, and occasionally *M. pennsylvanicus*) intermediate conditions can be found.

Mammæ.—In the subgenus *Microtus* the mammæ are always eight, four pectoral and four inguinal. No exceptions to this number are known.

Feet.—There are six turbercles on the sole. Five of these are always well developed, but the sixth is variable in size, being especially large in *M. ratticeps*. The sole is always moderately hairy from heel to tubercles. It is never densely furred as in *Phaiomys* or naked as in *Neofiber*. The claws on all four feet are moderately developed, those on the hind feet always slightly larger than those on the front feet, the latter never specially developed for digging (cf. *Pitymys*).

Fur.—The fur is moderately full and soft, neither long and silky as in *Phaiomys* nor dense and mole-like as in *Pitymys*.

General remarks.—The subgenus *Microtus* needs comparison with the groups having normal or very slightly abnormal palates: *Arvicola*, *Pedomys*, *Pitymys*, *Chilotus*, *Phaiomys*, and *Lagurus*. From all the others it differs too widely to give rise to confusion. *Lagurus* is distinguished from *Microtus* by the tightly closed triangles in the posterior mandibular tooth, *Arvicola* by the presence of large musk glands on the sides, *Pedomys* and *Pitymys* by reduction in the numbers of both mammæ and plantar tubercles, *Chilotus* by reduction in the latter only, and *Phaiomys* by an increase in the number of mammæ and by the very large claws. More extended comparisons will be found under each of these subgenera.

This subgenus is the most widely and generally distributed, as well as the one containing the largest number of species. Although the species of *Microtinæ* are still very imperfectly known, there is little doubt that the members of the subgenus *Microtus* greatly outnumber the species of all the other genera and subgenera together. Conspicuous representatives of the subgenus *Microtus* are (in the Old World): *Microtus arvalis* (Pall.), *M. agrestis* (Pall.), *M. ratticeps* (Keys. & Blas.), *M. nivalis* (Martins), *M. guentheri* (Dansford & Alston), *M. sikkimensis* (Hodgson); (in America): *Microtus pennsylvanicus* (Ord), *M. terrænovæ* (Bangs), *M. xanthognathus* (Leach), *M. chrotorrhinus* (Miller), *M. longicauda* (Merriam), *M. mogollonensis* (Mearns), *M. townsendi* (Bachman).

Subgenus ARVICOLA Lacépède.

1801. *Arvicola* Lacépède, Mém. de l'Institut, Paris, III, p. 489, 1801 (genus). Type, '*Arvicola amphibius*' = *Mus terrestris* Linn.
1883. *Arvicola* Lataste, Le Naturaliste, Tome, II, p. 349, 1883 (subgenus).
1836. *Hemiotomys* De Sélys Longchamps, Essai Monographique sur les Campagnols des environs de Liège, p. 7, 1836, part (included *arvalis* and *terrestris*).
1857. *Paludicola* Blasius, Fauna der Wirbelthiere Deutschlands, I, p. 333, 1857, part (included *terrestris*, *nivalis*, and *ratticeps*).
1867. *Ochetomys* Fitzinger, Sitzungsber. K. Akad. Wiss. Wien, LVI, p. 47, 1867. (No type mentioned, but genus intended to include all the water rats of Europe.)
1867. *Praticola* Fatio, Les Campagnols du Bassin du Léman, p. 36, 1867, part (included *terrestris*, *nivalis*, *arvalis*, *ratticeps*, and *campestris*).
1894. *Aulacomys* Rhoads, American Naturalist, XXVIII, p. 182, 1894. Type, *Aulacomys arvicoloides* Rhoads.

Geographic distribution of type species.—Northern Europe.

Geographic distribution of subgenus.—Northern part of Northern Hemisphere, exclusive of America east of the Rocky Mountains.

Essential characters:

Palate slightly abnormal.
$\overline{\text{m 3}}$ occasionally with closed triangles.
$\overline{\text{m 1}}$ normally with 3 to 5 closed triangles and 7 to 9 salient angles.
$\underline{\text{m 3}}$ normally with 2 or 3 closed triangles and 6 to 8 salient angles.
Mammæ.8.
Plantar tubercles 5.
Sole almost naked.
Claws on hind feet longest.
Fur slightly modified.
Musk glands present on sides of body.

Skull.—The skull of the larger Old World species of *Arvicola* (Pl. I, fig. 9) is nearly as large as that of *Neofiber*. In the American species

(Pl. I, fig. 1) it is smaller, though considerably larger than in most species of *Microtus* proper. Aside from its large size and prominent ridges, the skull of *Arvicola* differs from that of *Microtus* in its broader, shorter brain case, more widely flaring zygomatic arches, and proportionally slender rostrum. The peculiar appearance of the rostrum is heightened by the fact that the incisors project more than usual. Some of these characters are more noticeable in the American species, though the latter show no cranial peculiarities of sufficient importance to separate them subgenerically from those of the Old World. In the American species the skull is usually more lightly built and less strongly angular than in the typical members of the genus (compare figs. 1 and 9 of Pl. I).

Bony palate.—The bony palate is usually normal, but occasionally the median sloping ridge is divided in the median line, so that the interpterygoid fossa is hastate anteriorly (Pl. III, fig. 7). This condition occurs most frequently in the American species, but even among these it is inconstant.

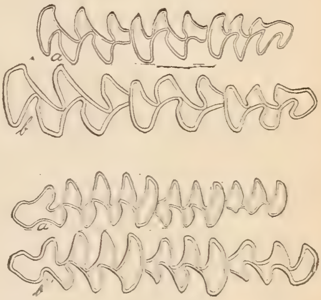


FIG. 34.—Enamel pattern of molar teeth, (*a*) *Microtus* (*Arvicola*) *macropus*; (*b*) *M.* (*A.*) *terrestris*. (x 5.)

Enamel pattern in general.—The enamel pattern in typical *Arvicola* (fig. 34*b*) is characterized by the great reduction in the number of closed triangles and salient angles in the front lower molar and back upper molar. In these peculiarities, though closely approached by *Pitymys*, *Pedomys*, and *Phaiomys*, it presents the extreme conditions found in the genus. The third lower molar shows the tendency to closure of the lateral triangles characteristic of all the larger members of the genus. The pattern of enamel folding in the molar teeth of the American species of *Arvicola* (fig. 34*a*) is, on the other hand, exactly like that of the tetramerodont species of the subgenus *Microtus* (e. g., *Microtus arvalis* and most of the western American species).

Front lower molar.—In the typical species the simplification in the structure of the teeth is carried furthest in the first lower molar. This tooth normally contains a posterior transverse loop followed by three closed triangles (one on the outer side, two on the inner side) and a terminal transverse loop which is deeply constricted in the middle. Each transverse loop forms two salient angles and each lateral triangle one, making seven in all. Deviations from this form are very rare. In one or two specimens I have seen a fourth triangle isolated on the outer side, thus producing a tooth much like the corresponding one in *Microtus* (*Microtus*) *ratticeps*, a species which has the last upper molar very complicated in structure. The front lower molar in typical *Arvicola* differs from that of the other groups in which it has only three closed triangles in the reduced number of salient angles—seven instead of nine. Since this tooth in the American species has the same structure as in *Microtus arvalis*, no special description is necessary.

Back upper molar.—In the typical species the last upper molar has an anterior transverse loop, a closed triangle on each side, and a very short, simple terminal loop. With these loops are associated six salient angles, two on each of the terminal loops and one on each closed triangle. Rarely the posterior terminal loop is reduced by the isolation of the outer basal angle as a third closed triangle, but this seldom happens, while the resulting form of tooth is quite different from that found in any member of the subgenus *Microtus* except the aberrant *M. nivalis*. In the American species this tooth is formed exactly as in *Microtus arvalis.*

Mammæ.—There are eight mammæ in *Arvicola*, as in *Microtus.*

Feet.—In *Arvicola* the soles are very sparsely haired or almost naked between the tubercles and the heel.

The tubercles are only five in number, as the small one which in *Microtus* lies midway between the large proximal tubercle and the base of the fifth toe is absent. Claws moderately developed, those on hind feet slightly the larger.

Fur.—The fur is close, dense, and long, the under fur especially thick and woolly. It thus resembles the fur of *Neofiber*, though the modification is not carried so far as in the latter.

Miscellaneous characters.—The species of *Arvicola* are provided with a large musk gland on each side of the abdomen. These glands lie immediately in front of the hind legs and are very conspicuous in alcoholic specimens. In a half-grown male *Microtus terrestris* from St. Petersburg, Russia, each gland is 13 mm. long by 6 mm. wide. They are regularly oval in outline, the long axis parallel with the long axis of the body. The surface, which is slightly raised above that of the surrounding skin, is closely and irregularly wrinkled, and has much the appearance of very finely honeycombed tripe. Each gland bears a sprinkling of fine hairs much shorter than the fur, but at first sight appears to be naked. In dried skins the positions of the glands are indicated by tufts of grease-soaked fur.

General remarks.—The subgenus *Arvicola* is distinguished from all other groups with similar enamel pattern or with like numbers of mammæ and foot pads by the presence of the large glandular masses on the sides of the body. The species are all water rats, and, with the exception of *Microtus* (*Neofiber*) *alleni*, they considerably exceed the other members of the genus in size.

Although this subgenus is now for the first time recorded from America, at least three species of *Arvicola* inhabiting the western United States have been described within the past five years. These are *Microtus macropus* (Merriam), *M. arvicoloides* (Rhoads), and *M. principalis* Rhoads. *Microtus macropus* was supposed to be "one of the western members of the subgenus or section *Mynomes*," that is, a tetramerodont *Microtus.*[1] *Microtus arvicoloides* was made by its describer the type of a new genus, *Aulacomys*,[1] while *M. principalis*, closely allied to both *M. macropus* and *M. arvicoloides*, was referred by the same author to true *Microtus*.[2] This confusion arose from the fact that the subgeneric and generic determinations were based chiefly on dental characters. Hence *Microtus macropus* and *M. principalis* were naturally considered members of the subgenus *Microtus*, since both have the enamel pattern characteristic of the tetramerodont species of that group.

---

[1] North American Fauna No. 5, p. 60, July, 1891.

The teeth of the type and only known specimen of *Microtus arvicoloides*, on the other hand, show certain characters which, although clearly abnormal, led to an entire misunderstanding of the animal's true relationships. The first of these abnormal characters, and the one which suggested the name *Aulacomys*, is seen in the upper incisors. Each of these has a narrow longitudinal median groove. They can not, however, be considered as entitling the species to generic rank, since similar though fainter grooves are occasionally found in almost any species of *Microtus*, while they are absent in the vast majority of specimens of '*Aulacomys*.' The second abnormality in the type of *Microtus arvicoloides* is in the form of the front lower molar. This tooth (fig. 35) has two reentrant angles on the outer side of the anterior loop instead of one as usual in *Microtus*. The supplemental reentrant angle, like the grooves in the incisors, is purely an individual character, which may crop out in any species of *Microtus*, with the front lower molar formed as in *M. arvalis*, and which is absent in all the other thirty or more specimens of '*Aulacomys*' that I have seen. The subgenus *Aulacomys* if retained as distinct from *Arvicola* must rest on characters of enamel pattern alone, since in all other peculiarities it agrees perfectly with the latter. The differences in enamel folds are rather considerable, since '*Aulacomys*' has the highly complicated pattern of true *Microtus*, while the species of typical *Arvicola* have the simplest pattern of any known. While it seems highly inadvisable to base subgeneric divisions on such characters, the decision rests on purely individual judgment.

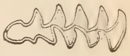


FIG. 35.—Abnormal front lower molar of type specimen of '*Aulacomys*' *arvicoloides*. (x4.)

In the Old World numerous species and subspecies are probably confused under the name '*Arvicola amphibius*.' *Microtus musignani* (De Sélys Longchamps) and *M. monticola* (De Sélys Longchamps) appear to be especially distinct from *M. terrestris* (Linn.).

Subgenus NEOFIBER True.

1884. *Neofiber* True, Science, IV, p. 34, July 11, 1884 (full genus). Type *Neofiber alleni* True.

1891. *Neofiber* Merriam, North American Fauna, No. 5, p. 59, July, 1891 (subgenus).

Geographical distribution of type species.—Florida. "Doubtless a common animal in favorable localities throughout the State." (Chapman.)

---

[1] American Naturalist, XXVIII, p. 182, February, 1894.

[2] American Naturalist, XXIX, p. 940, October, 1895.

Geographical distribution of subgenus.—The range of the subgenus *Neofiber* is the same as that of the type and only known species.

Essential characters:

Palate abnormal.
$\overline{\mathrm{m}\ 3}$ with all triangles closed.
$\overline{\mathrm{m}\ 1}$ with 5 closed triangles and 9 salient angles.
$\underline{\mathrm{m}\ 3}$ with 2 closed triangles and 6 salient angles.
Mammæ 4.
Plantar tubercles 5.
Sole naked.
Claws on hind feet longest.
Fur highly modified.

Skull.—The skull of *Neofiber* is characterized by its large size, great depth through the frontal region, and conspicuous development of postorbital processes. The ratio of fronto-palatal depth to basilar length is about 41 in *Neofiber*, while in true *Microtus* it is only about 35. As the occiput in *Neofiber* is not correspondingly high the dorsal outline of the skull curves gently and regularly from front to back, with the highest point just behind the orbits. When viewed from above the skull of *Neofiber* differs from that of *Microtus* chiefly in the larger squamosals, smaller parietals and interparietal, and in the sharp-pointed postorbital processes. The latter project over the orbital cavity as square-cornered shelves, which are especially noticeable when viewed from below.

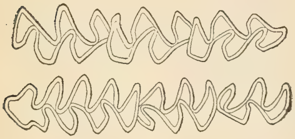


FIG. 36.—Enamel pattern of molar teeth, *Microtus* (*Neofiber*) *alleni*. (x 4.)

Palate.—The bony palate in *Neofiber* (Pl. II, fig. 9) differs widely from that of *Microtus*, and exactly resembles that of *Fiber* (p. 72).

Enamel pattern in general.—In general the enamel pattern of *Neofiber* (fig. 36) is characterized by a tendency to reduction in the number of angles in the variable teeth and to the tight closure of all triangles. The latter peculiarity gives the teeth the greatest possible strength.

Front lower molar.—The first molar in the lower jaw exactly resembles the corresponding tooth in *Microtus* except that the anterior loop is rather shorter than in the typical members of that subgenus. In one specimen (No. 23453, U. S. Nat. Mus.) the anterior loop has two indentations on the outer side, thus suggesting *Anaptogonia*.

Back upper molar.—The third maxillary tooth is like that in the subgenera *Pitymys*, *Pedomys*, *Phaiomys*, *Chilotus*, and typical *Arvicola*, as it has only two closed triangles and six salient angles.

Other teeth.—The back lower molar has all the triangles tightly closed, in this respect differing from all other subgenera except *Lagurus*. Closed triangles are sometimes formed in the third lower molar of almost any of the larger voles, but *Neofiber* and *Lagurus* are the only groups in which they are always present. Outside the subgenus *Lagurus*, most of the known species of which are small, the tendency to closure of the triangles in this tooth increases with the size of the animals until in such large species as *Microtus alleni* and the members of the genus *Fiber* they are always tightly closed. *Microtus terrestris*, the only species approaching *M. alleni* in size, has closed triangles in $\overline{\mathrm{m}\ 3}$ very often, while in one specimen the tooth is formed exactly as in *Neofiber*. *M. principalis* Rhoads, another large species, also rather frequently shows closed triangles in this tooth. The incisors, like those of *Fiber*, are short, broad, and very strong, in this respect reaching the opposite extreme from that attained by '*Aulacomys*.'

Mammæ.—Apparently the number of mammæ in *Neofiber* has never been stated in print. Mr. Outram Bangs writes me, however, that he found four inguinal teats in an adult female *Microtus alleni* which he took in Brevard County, Fla., during February, 1895.

Feet.—Soles wholly naked, foot pads five, as in *Arvicola;* claws on hind feet longest.

Fur.—The fur is modified to meet the requirements of an aquatic life in the same way and to almost the same extent as in the genus *Fiber*. The under fur is exceedingly thick, woolly, and dense, while the longer hairs are very glossy and lustrous. This condition is suggested in *Arvicola*, where, however, the modification is not carried so far.

Miscellaneous characters.—Whether *Neofiber* is provided with musk glands like those of the other water rats is at present uncertain. Collectors have failed to notice them, but they might easily escape detection in the thick fur unless specially searched for. The only alcoholic specimen that I have examined is not full grown. This shows no trace of the glands even when the skin of the sides is raised and examined from beneath.

General remarks.—In *Neofiber* are combined the mandibular enamel pattern of *Lagurus* with the maxillary enamel pattern and external characters of typical *Arvicola*, complicated by a reduction in the number of mammæ as in *Pedomys* and *Pitymys*.

Genus FIBER Cuvier.

Fiber Cuvier [Tabl. Élém. de l'Hist. Nat. des Anim., p. 141, 1798], Leçons d'Anat. Comp., I, tabl. I, 1800. Type *Castor zibethicus* Linn.

Geographic distribution of type species.—North America north of the southern border of the United States.

Geographic distribution of genus.—The range of the genus *Fiber* is essentially the same as that given for the type species.

Essential characters:

Upper incisors with anterior faces smooth.
Lower incisors with roots on outer side of molars.
Molars rooted.
Enamel pattern characterized by approximate equality of reentrant angles on outer and inner sides of molars.
Feet modified for swimming.
Tail flattened laterally.

Skull.—The skull (fig. 37) differs very slightly from that of *Microtus* except that it is considerably larger than in any known species of the latter, and has a proportionally longer rostrum. The bony palate (Pl. II, fig. 12) resembles that of the species of *Alticola* and *Neofiber* in the extension forward of the interpterygoid fossa and suppression of the sloping part of the median ridge. The posterior border is thus squarely cut off immediately behind the lateral bridges. A vestige of the sloping ridge usually persists in the form of a median spine projecting into the interpterygoid space. The skull of *Fiber* is peculiar in the expansion of the squamosals on the dorsal surface of the skull at the expense of the parietals. The postorbital processes of the squamosals form prominent triangular projections closely resembling those of *Neofiber*. The interparietal is squarish in outline and usually somewhat longer transversely than antero-posteriorly.

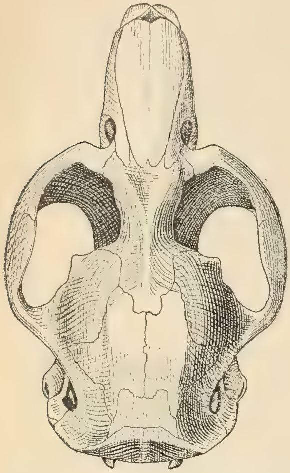


FIG. 37.—Skull of *Fiber zibethicus* (natural size).

Teeth.—The molars are all rooted in the adults (fig. 38), though the roots on the back lower tooth are usually less well developed than those on the others. Otherwise the teeth are exactly as in *Microtus*. The enamel pattern (fig. 39), most closely resembles that of *Microtus* (*Neofiber*) *alleni*, but differs in the larger anterior loop of the first lower molar. This loop is cut by two deep reentrant angles, which often isolate two additional closed triangles, making seven in all.

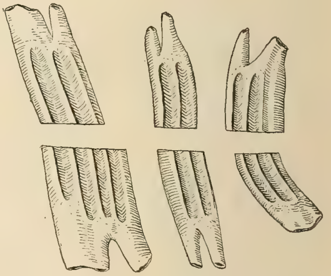


FIG. 38.—Side view of molars, *Fiber zibethicus*. (x 1½.)

Feet.—The feet are large and so formed that they can be turned edgewise when carried forward, thus producing the least possible resistance to the water while the animal is swimming. This character is, however, to a certain extent, reproduced in the more aquatic species of *Microtus* and can not be considered diagnostic of *Fiber*.

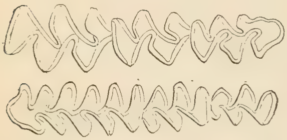


FIG. 39.—Enamel pattern of molar teeth, *Fiber zibethicus*. (x 2½.)

Miscellaneous characters.—The tail is strongly compressed laterally, making an effective rudder. The peculiar form of the tail is scarcely noticeable in the young even when large enough to leave the nest, but develops rapidly as the animals increase in size.

The fur of the species of *Fiber* is highly modified to produce a thoroughly waterproof covering. The long hairs are remarkably close and glossy, while the under fur is very dense. In the character of the fur *Fiber* is approached by some of the aquatic species of *Microtus*, especially *M.* (*Arvicola*) *terrestris* and *M.* (*Neofiber*) *alleni.*

General remarks.—Fiber is very closely related to *Microtus*, from which it is distinguished by its flattened, rudder-like tail, and rooted molars.

In addition to the well-known musk rat, *Fiber zibethicus*, three forms, whose interrelationships are not yet understood, are now recognized. These are: *Fiber zibethicus pallidus* Mearns, *F. obscurus* Bangs, and *F. rivalicius* Bangs.

DESCRIPTIONS OF EXTINCT GENERA AND SUBGENERA.

Three extinct rodents referred by authors to the family *Microtinæ* have been made the types of superspecific groups. Two of these, from the Postpliocene of Pennsylvania, are subgenera of *Microtus*; the third, from the Quaternary phosphorites of Trara de Nédroma, near Ain-Mefta, Tunis, is a genus of doubtful affinities. As these groups are necessarily based almost wholly on dental characters, it is impossible to describe them in the same manner as the living genera and subgenera. It is furthermore impossible to form a clear judgment of the validity of the groups in question without examination of the actual specimens. Such examination I have not been able to make. Hence the few conclusions here reached are necessarily incomplete and unsatisfactory.

The genus *Bramus* Pomel (Comptes Rendus, Paris, CXIV, p. 1159, 1892), from the Quaternary Phosphorites of Tunis is represented by one species, *Bramus barbarus* Pomel. Of this animal the mandible and the teeth of both jaws are known.[1] These show characters which suggest the *Castoridæ*.

---

[1] Les molaires montrent sur leur couronne la structure de celles du rat d'eau, dont elles ont à peu près les dimensions. On y voit une double série d'encoches et d'angles alternatifs qui correspondent latéralement à des arêtes saillantes, 5 en dedans et 4 en dehors à la première dent inférieure, 3 de chaque côté aux deux suivantes inférieures et aux deux premières supérieures et 2 seulement avec arête postérieure à la troisième d'en-haut. Chez *Arvicola* cette dernière est beaucoup plus compliquée, ayant trois paires d'arêtes et un fort contrefort postérieur. Dans la fossile les sillons sont moins profonds, à angles moins vifs, ainsi que les arêtes, et les lignes d'émail ne se soudent pas d'un côté à l'autre de la couronne, ainsi qu'elles le font chez *Arvicola*; il en résulte une ligne médiane continue de dentine sur la couronne, au lieu d'une série alternative de petits triangles bordés d'émail; de sorte que la dent d'*Arvicola* est, en réalité, formée de deux rangées de prismes distincts, tandis que celle du fossile est un prisme unique fortement sillonné sur les côtés. Il y a plus de ressemblance avec certains Gerbilles, qui ont cependant les molaires bien moins prismatiques et autrement constituées.

Les molaires des *Arvicola* ne sont jamais radiculées sauf peut-être chez les très vieux sujets. Dans notre fossile, je les ai trouvées toujours radiculées dès qu'elles percent l'alvéole dentaire; leur fût, quoique franchement prismatique, est bien moins allongé. Ses deux racines, à la vérité, sont très longtemps ouvertes à leur extrémité,

The molars, which are rooted, do not differ essentially in enamel pattern from those of living species of *Microtus*, except that the back upper tooth is remarkably simple in structure, and the reentrant angles in all the teeth are so shallow that the triangles are open. While the front lower molar has nine salient angles, as in typical *Microtus*, the posterior maxillary tooth has only four and a very small terminal loop. The author remarks that the open triangles give the teeth of *Bramus* a resemblance to those of some of the *Gerbillidæ*, but this likeness must be very superficial. The most remarkable character of *Bramus* is the form of the mandible, which is like that of *Castor* and very unlike that of any of the *Muridæ*. It is probable that *Bramus* is the type of a group differing too widely from any of the recent *Microtinæ* to be united with them in one subfamily.

The subgenera *Isodelta* and *Anaptogonia* were described by Prof. E. D. Cope in 1873 (Proc. Amer. Philos. Soc., XII, p. 87). Both are based on teeth from the Postpliocene deposit in Port Kennedy Cave, Pennsylvania. *Anaptogonia* is very different from any of the living subgenera of *Microtus*—so different that, as Professor Cope suggests, it may be eventually recognized as a distinct genus. *Isodelta*, on the other hand, is hardly separable from *Pitymys*, since the characters pointed out as diagnostic of the two groups are not beyond the range of variation among the species of one subgenus.

The original description of *Microtus hiatidens*, the type of the subgenus *Anaptogonia*, is as follows:

> Represented by several molar teeth. These are several times as large as the teeth occupying the same position in any of the species already mentioned in this essay, and suggest the genus *Fiber*. The distinctive features of the latter are the compressed, oar-like tail, with rooted molars, and it is evident that the relationship of this species is not to it. Perhaps it is neither an *Avicola* (sic.) [=*Microtus*] nor a *Fiber*, since it differs in the structure of the teeth from the known species of both. None of the triangles are isolated, but are connected by a narrow strip of dentine, which is narrow posteriorly, but widens anteriorly until it opens out into the terminal loop. Thus the sectional name *Anaptogonia* may be found ultimately applicable to a separate genus. The separation of the enamel folds merely carries to the highest degree that which is seen in the anterior part of the tooth of *A. sigmodus*.
>
> In the inferior m 1 the triangles, which do not open on one side to the anterior loop, are $1\frac{4}{3}$, then one on each side, and the short, wide, terminal loop, which is bilobed or emarginate in the middle of the end. The ridges, which are very prominent and acute, are, therefore, $\frac{6}{5}$; at the extremity there are two short ones, between

---

mais elles sont de bonne heure parfaitement distinctes l'une de l'autre. La troisième molaire inférieure, un peu plus arquée que dans *Arvicola*, ne descend pas à la face interne de l'incisive, mais reste tout à fait au-dessus, et ses racines seules s'insinuent un peu latéralement sur cette face.

L'os mandibulaire présente des différences beaucoup plus importantes. Son apophyse angulaire, restant presque dans le plan général de l'os, ne fait en arrière qu'une légère saillie bordant la branche montante, qu'elle suit très haut sous le condyle pour se terminer en simple petit cran. Il y a une grande analogie de forme avec ce que l'on voit chez les Castors. Dans *Arvicola*, au contraire, l'apophyse angulaire est basse et se rejette obliquement en arrière en forme de cuilleron fortement crochu et tordu, rappelant du reste, sauf cette torsion la disposition de cette partie chez les autres Muridés.

which a third and more prominent one rises a little below the grinding surface. A little more attrition would give the distal loop a trilobate outline, and a little more, an acuminate one, from the loss of the lateral angles; finally the median ridge disappears also.

The subgenus *Isodelta* is considered by Professor Cope to show an exaggeration of the characters of *Pitymys.* The type and only known species, *Microtus speothen,* is described as follows:

> This species is represented by the entire dentition of the left ramus mandibuli, with a few fragments of the adjacent bone. As already pointed out, its characters entitle it to rank as a distinct section of the genus. Thus, the triangles of the inner side of the anterior inferior molar are one less than in any species of the section *Arvicola* [=*Microtus*]. The anterior loop presents two well-marked angular basal areas, while its terminal portion is regularly rounded. * * * That this is not one of the species of *Pitymys*, in which the basal lobe of the anterior trefoil has been cut off by unusual inflexion of the enamel angle, is demonstrated by the structure of the second molar, which is precisely that of typical *Arvicola* [=*Microtus*], all the triangles from the posterior being isolated and alternating, producing the formula 1 $\frac{2}{2}$ 0. The third molar has the usual formula, 1–1–1, the posterior two lobes being crescentic, the anterior trapezoid.

NOTE ON ARVICOLA INTERMEDIUS NEWTON.

In a paper entitled 'The Vertebrata of the Forest Bed Series of Norfolk and Suffolk'[1] Mr. E. T. Newton describes numerous remains of a microtine rodent with well-developed fangs on the molar teeth and intermediate in size between *Arvicola amphibius* [=*Microtus terrestris*] and the smaller voles. This animal, which Mr. Newton named *Arvicola intermedius,* has been recently referred to the genus *Phenacomys.*[2] While the species is certainly not an *Arvicola* [=*Microtus*], it appears to be equally far removed from *Phenacomys* and probably from *Evotomys* and *Fiber* also. The teeth are described as follows:

> I have now before me about 40 vole jaws from the "Forest Bed" which, although differing somewhat in size, agree precisely in the patterns of their teeth. Only 14 of these allow the bases of their teeth to be seen, but nine of these have more or less distinct fangs; the other five have no fangs, but are most probably immature, as in other particulars they agree precisely. I have likewise some hundreds of isolated molar teeth, and a very large proportion of these are fanged. * * * The great variation in the size of these fanged teeth would lead one to suspect that they represent more than one species, but there are no sufficient grounds for their separation. * * * The patterns of the grinding teeth are so nearly like those of *A. amphibius* as scarcely to need description, and it is on the presence of fangs in the adult that the chief distinction between the two species rests; nevertheless, there are a few points deserving of notice. In one of the largest and most perfect mandibular rami (figs. 3, 3*a*) the entire molar series, measured along the alveolar margin, is 0.33 inch (8.5 mm.). Mr. Reeves's specimen, from the Bramerton Crag (fig. 12), is a little larger. The first molar has the five inner and four outer angles alternating, but the anterior two are not so prominent as is usually the case in *A. amphibius,* and the front of the tooth is somewhat more rounded (fig. 3*b*). In the Bramerton jaw this is especially the case (fig. 12*a*). All the anterior lower teeth from the "Forest Bed" series which I have seen have the infoldings of the enamel behind the anterior prism less deep than in those examples of *A. amphibius* which I have been able

---

[1] Memoirs of the Geological Survey, England and Wales. London, 1882.

[2] Nehring, Naturwissenschaftliche Wochenschrift, Nr. 28, July 15, 1894.

to examine; and hence the dentinal portion of the anterior prism is more widely confluent with the second inner and outer prisms; it is, in fact, an exaggeration of the form indicated by Blasius, fig. 186 (Säugethiere Deutschlands, p. 345). The second molar has three inner and three outer angles alternating. The third molar has likewise three inner and three outer angles, but the alternation of the prisms is so slight that the opposing inner and outer prisms are confluent. * * * I am not acquainted with any specimen which shows the three upper molars in place, but Mr. Savin has two specimens which retain the first and second upper grinders (fig. 1), and Mr. Reid has obtained several isolated specimens of last upper molars. The anterior upper molar (fig. 1*a*) has three inner and three outer angles alternating; the second tooth has three outer and two inner angles alternating. The third upper molars vary somewhat; in some only three inner and three outer angles can be counted (fig. 2*a*), while others have three inner and four outer angles. The widely confluent character of the front prisms of the lower anterior molar is repeated in these hinder upper ones. It will be noticed that in all Blasius's figures of the last upper teeth (l. c., p. 345) the anterior inner fold (cement space) and the two anterior outer folds extend across the teeth and meet the enamel of the opposite side, while in one case (fig. 190) the two inner folds pass across. Now, in most of the teeth under consideration it is only the one anterior inner and one anterior outer fold which pass across; in some instances the second outer fold passes farther inward, but I do not think that in any instance it touches the opposite side.

The teeth of '*Arvicola*' *intermedius* differ in numerous characters from those of *Fiber*, *Evotomys*, and *Phenacomys*, the only known living microtines with rooted molars. The small size of the remains and the simple structure of the first lower molar are sufficient to indicate that the animal is not closely related to *Fiber*, although the character of the roots of the molars, as shown in figs. 5, 6, and 7 of Pl. XIII, is strongly suggestive of this genus. The figure of the inner side of the lower jaw (Pl. XIII, fig. 3*a*) suggests that the posterior molar is strongly displaced by the shaft of the incisor, as in *Microtus*. This character alone would show that the species is neither an *Evotomys* nor a *Phenacomys*; but the peculiarities of the enamel pattern furnish additional reasons for its exclusion from these genera. The enamel pattern (fig. 40) is, as Mr. Newton remarks, almost exactly like that of *Microtus terrestris* (see fig. 34). It thus lacks the deep reentrant angles on the inner side of the lower molars characteristic of *Phenacomys*, and the rounded salient angles and opposite triangles characteristic of *Evotomys*. The last lower molar in particular is noticeably different from that of either *Evotomys* or *Phenacomys*. '*Arvicola*' *intermedius* is apparently still further removed from *Evotomys* by the large size of the teeth as compared with the jaw. There can be little doubt that the animal represents a genus distinct from any now living.[1] In the absence of specimens, however, nothing would be gained by an attempt to name and define the group.

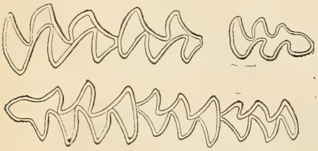


FIG. 40.—Enamel pattern of molar teeth, *Arvicola intermedius*. From Newton.

---

[1] Whether the rooted microtine teeth mentioned by Nehring (Naturuissenschaftliche Wochenschrift, Nr. 28, July 1894) and by Forsyth Major (Atti Soc. Ital. Sci. Nat., XV, p. 389) belong to animals congeneric with *Arvicola intermedius* is purely a matter of conjecture.

INDEX.

[Synonyms in italics.]

Agricola, 17, 19, 21, 62.
Alticola, 9, 17, 19, 23, 52–54.
Alviccola, 15.
Ammomys, 15, 58.
Anaptogonia, 17, 74–75.
Anteliomys, 9.
Arctomys, 13.
Arvicola, 9, 14.
Arvicola, 14.
    amphibius, 14.
    intermedius, 75–76
Arvicolinæ, 8.
Aulacomys, 18, 69.
Baird, classification adopted by, 21–22.
Blanford, classification adopted by, 23.
Blasius, classification adopted by, 21.
Bony palate, 26–28.
Borioikon, 17, 38.
Brachyurus, 15.
Bramus, 18, 73–74.
    barbarus, 73–74.
Büchner, opinion on taxonomic value of enamel pattern, 25.
Campicola, 18, 62.
Castor, 12.
Chilotus, 9, 16, 19, 22, 60–62.
Coues, classification adopted by, 22–23.
Cuniculus, 12.
Cuniculus, 16, 38.
De Sélys-Longchamps, classification adopted by, 19–21.
Dicrostonyx, 8, 9, 16, 38–40.
    torquatus, 9, 40
Enamel pattern, 25.
Eothenomys, 9, 45–47.
Eremiomys, 17, 50.
Evotomys, 8, 9, 17, 22, 28, 42–44.
    californicus, 44.
    fuscodorsalis, 44.
    galei, 44.
    gapperi, 44.
    glareolus, 44.
    idahoensis, 44.
    occidentalis, 44.
    rufocanus, 44.
    rutilus, 9, 44.
Fatio, classification adopted by, 22.
Fiber, 8, 9, 14, 71–73.
    obscurus, 73.
    rivalicius, 73.
    zibethicus, 9, 71–73.
Glis, 12.
Glis, 12, 13.
Hemiotomys, 16, 19, 20, 22, 62.
History of classifications, 19–24.
Hyperacrius, 9.
Hypudæus, 14, 21, 22.
Interpterygoid fossa, 27.
Isodelta, 17, 74–75.
Keys, 28–32.
Lagomys, 13.
Lagurus, 9, 16, 49–51.
Lasiopodomys, 18, 24, 57.
Lataste, classification adopted by, 23–24.
Lateral bridges, 27.
Lateral grooves, 27.
Lemmi, 8.
Lemmings, 8.
Lemmus, 8, 9, 13, 36–37.
    lemmus, 9, 37.
    nigripes, 37.
    obensis, 37.
    schisticolor, 37.
Marmota, 13.
Maxillo-palatine suture, 26.
Microti, 8.
Microtinæ, geographic distribution, 9–10.
    habits, 10–11.
    lists of genera and subgenera, 9.
    subfamily and divisions, 8–9.
Microtus, 8, 9, 14, 19, 20, 21, 24, 44–71.
    agrestis, 66.
    albicauda, 54.
    alleni, 9, 69–71.
    arvalis, 9, 62, 66.
    arvicoloides, 68–69.
    austerus, 9, 55–56.
    blanfordi, 54.
    blythii, 9, 57, 58.
    brandti, 58.
    characters on which present classification of subgenera is based, 24–28.
    chinensis, 9, 47–49.
    chrotorrhinus, 66.
    curtatus, 51.
    fertilis, 9, 54–55.
    fuscus, 58.
    (genus), 44–45.
    guentheri, 66.
    hiatidens, 74–75.
    lagurus, 9, 49, 51.
    longicauda, 66.
    luteus, 49, 51.
    macropus, 69.
    mandarinus, 58.
    melanogaster, 9, 45–47.
    middendorffi, 24, 49.
    mogollonensis, 66.
    monticola, 69.

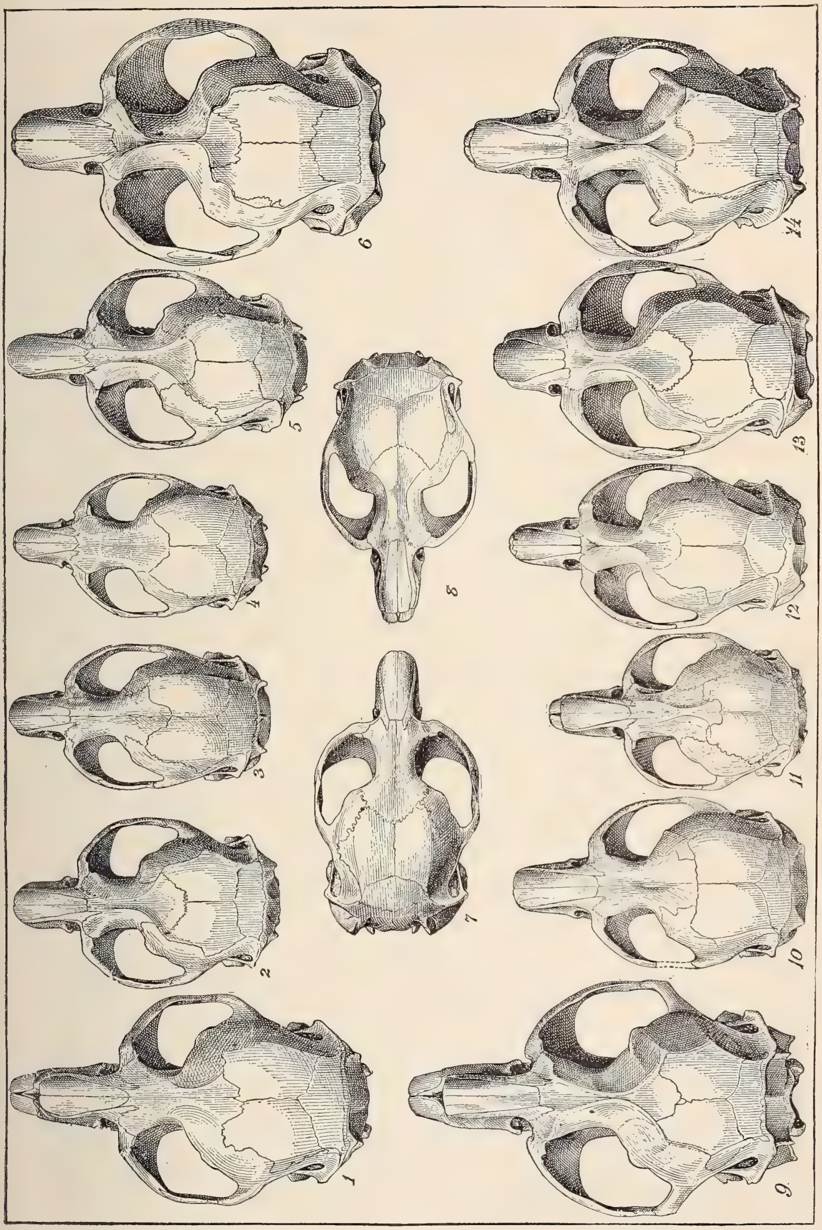
Microtus musignani, 69.
  nivalis, 66.
  oregoni, 9, 60–62.
  pallidus, 51.
  pauperrimus, 51.
  pennsylvanicus, 66.
  (pentamerodont species), 65.
  pinetorum, 9, 58, 59.
  principalis, 69.
  przewalskii, 51.
  quasiater, 60.
  ratticeps, 66.
  roylii, 54.
  savii, 60.
  sikkimensis, 65, 66.
  speothen, 75.
  stoliczkanus, 9, 52, 54.
  stracheyi, 54.
  strauchi, 58.
  (subgenus), 62–66.
  subterraneus, 60.
  terrænovæ, 66.
  terrestris, 9, 66, 69.
  (tetramerodont species), 65.
  townsendi, 66.
  wynnei, 55.
  xanthognathus, 66.
Micrurus, 17, 58.
Mictomys, 9, 18, 35–36.
Misothermus, 16, 38.
Mus, 11.
  amphibius, 11.
  terrestris, 11.
Mynomes, 15, 19, 20, 21, 23, 62.
Myocastor, 13.
Myodes, 15, 20, 24.
Myolemmus, 16, 38.
Myotalpa, 8.
Myotalpinæ, 8.
Neodon, 16, 19, 23, 62, 65.
Neofiber, 9, 17, 19, 69–71.
Nomenclature, 11–19.
Ochetomys, 17, 66.
Ondatra, 13.
Palatine bone, 27.
Paludicola, 17, 19, 21, 23, 62.
Pedomys, 9, 16, 19, 22, 55–56.
Pentamerodont species of Microtus, 65.
Phaiomys, 9, 17, 56–58.
Phenacomys, 8, 9, 18, 40–42.
  celatus, 42.
  intermedius, 9, 42.
  latimanus, 42.
  longicauda, 10, 42.
  oramontis, 42.
  orophilus, 42.
  truei, 42.
  ungava, 42.
Pinemys, 16, 58.
Pitymys, 9, 15, 19, 22, 24, 58–60.
Praticola, 17, 22, 62.
Psammomys, 15, 58.
Siphneinæ, 8.
Siphneus, 8.
Sylvicola, 17, 22, 62.
Synaptomys, 8, 9, 16, 32–36.
  cooperi, 9, 35.
  dalli, 36.
  fatuus, 35.
  helaletes, 35.
  innuitus, 9.
  (subgenus), 34–36.
  truei, 36.
  wrangeli, 36.
Terricola, 17, 58, 62.
Tetramerodon, 18, 62.
Tetramerodont species of Microtus, 65.
Voles, 8.

PLATE I.

[Enlarged one and one-half times.]

FIG. 1. *Microtus* (*Arvicola*) *macropus*. Wood River, Idaho.
(No. 31630, U. S. Nat. Mus.)
2. *Microtus* (*Pitymys*) *pinetorum*. Washington, D. C.
(No. 30332, U. S. Nat. Mus.)
3. *Microtus* (*Microtus*) *arvalis*. Cepin, near Esszek, Slavonia.
(No. 3035, collection of Gerrit S. Miller, jr.)
4. *Evotomys*. Portland, N. Dak.
(No. 35835, U. S. Nat. Mus.)
5. *Phenacomys oramontis* Rhoads. Mount Baker Range, British Columbia.
(No. 3562, collection of Gerrit S. Miller, jr.)
6. *Lemmus nigripes*. St. George Island, Alaska.
(No. 42680, U. S. Nat. Mus.)
7. *Microtus* (*Lagurus*) *curtatus*. Reese River, Nevada.
(No. 32498, U. S. Nat. Mus.)
8. *Microtus* (*Chilotus*) *oregoni*. Sumas, British Columbia.
(No. 4160, collection of Gerrit S. Miller, jr.)
9. *Microtus* (*Arvicola*) *terrestris*. Braunschweig, Germany.
(No. 1934, collection of C. Hart Merriam.)
10. *Microtus* (*Alticola*) *albicauda*. Type. Braldu Valley, Ballistan.
(No. 36916, U. S. Nat. Mus.)
11. *Microtus* (*Hyperacrius*) *fertilis*. Pir Panjal Range, Kashmir.
(No. 35511, U. S. Nat. Mus.)
12. *Synaptomys* (*Mictomys*) *wrangeli*. Wrangel, Alaska.
(No. 74720, U. S. Nat. Mus.)
13. *Synaptomys* (*Synaptomys*) *helaletes*. Dismal Swamp, Virginia.
(No. 75172, U. S. Nat. Mus.)
14. *Dicrostonyx torquatus*. Petschora, Russia.
(No. 3621, collection of Gerrit S. Miller, jr.)

PLATE I.



1. *Microtus macropus.*
2. *Microtus pinetorum.*
3. *Microtus arvalis.*
4. *Evotomys gapperi.*
5. *Phenacomys oramontis.*
6. *Lemmus nigripes.*
7. *Microtus curtatus.*
8. *Microtus oregoni.*
9. *Microtus terrestris.*
10. *Microtus albicauda.*
11. *Microtus fertilis.*
12. *Synaptomys wrangeli.*
13. *Synaptomys helaletes.*
14. *Dicrostonyx torquatus.*

PLATE II.

[Enlarged two and one-half times.]

FIG. 1. Bony palate of *Phenacomys*. Salmon River Mountains, Idaho.
(No. 31249, U. S. Nat. Mus.)

2. Bony palate of *Microtus* (*Lagurus*) *pallidus*. Reese River, Nevada.
(No. 32498, U. S. Nat. Mus.)

3. Bony palate of *Microtus* (*Pitymys*) *pinetorum*. Washington, D. C.
(No. 30332, U. S. Nat. Mus.)

4. Bony palate of *Microtus* (*Alticola*) *blanfordi*. Nultar Valley, Kashmir.
(British Museum Register, 81. 3. 1. 23.)

5. Bony palate of *Microtus* (*Microtus*) *arvalis*. Geneva, Switzerland.
(British Museum Register, 79. 9. 25. 52.)

6. Bony palate of *Microtus* (*Lagurus*) *lagurus*. Gurjeff, Russia.
(No. 3619, collection of Gerrit S. Miller, jr.)

7. Bony palate of *Microtus* (*Arvicola*) *arvicoloides*. Type. Lake Kichelos, Washington.
(No. 1358, collection of S. N. Rhoads.)

8. Bony palate of *Microtus* (*Anteliomys*) *chinensis*. Type. Western Sze-chuen, China.
(British Museum Register.)

9. Bony palate of *Microtus* (*Neofiber*) *alleni*. Florida.
(No. 23452, U. S. Nat. Mus.)

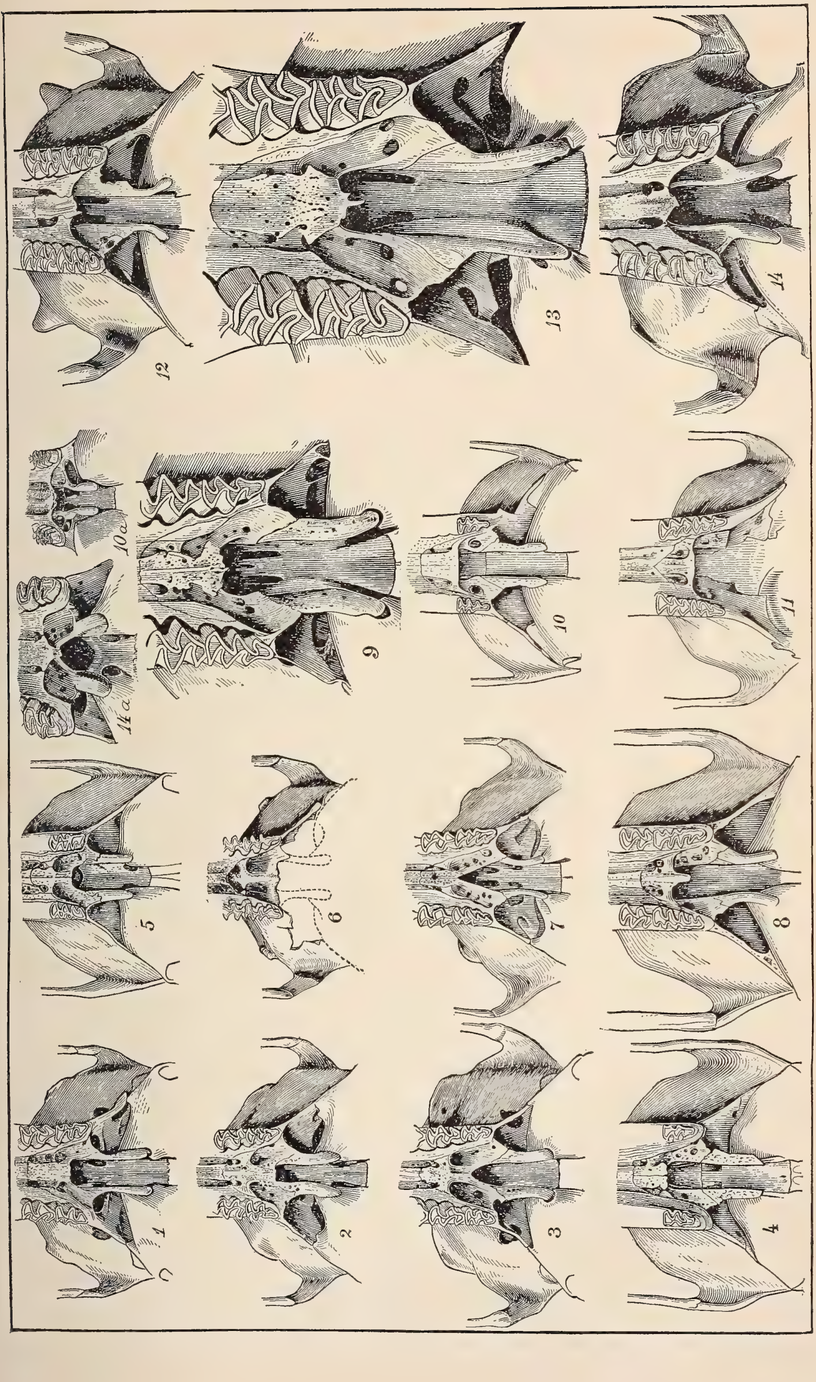
10. Bony palate of *Evotomys glareolus*. Christiania, Norway.
(British Museum Register, 84. 10. 31. 11.)
    - 10. View perpendicular to plain of palate.
    - 10*a*. View from below and behind at strong angle with plain of palate.

11. Bony palate of *Microtus* (*Eothenomys*) *melanogaster*. Western Fokien, China.
(British Museum Register, 92. 10. 12. 52.)

12. Bony palate of *Dicrostonyx torquatus*. Petschora, Russia.
(No. 3621, collection of Gerrit S. Miller, jr.)

13. Bony palate of *Fiber*. Lake George, New York.
(No. 67689, U. S. Nat. Mus.)

14. Bony palate of *Lemmus lemmus*. Vola. (From St. Petersburg Museum.)
(No. 3620, collection of Gerrit S. Miller, jr.)
    - 14. View perpendicular to plain of palate.
    - 14*a*. View from below and behind at strong angle with plain of palate.



1. Phenacomys.
2. Lagurus.
3. Pitymys.
4. Alticola.
5. Microtus.
6. Lagurus.
7. Arvicola.
8. Anteliomys.
9. Neofiber.
10. Evotomys.
11. Eothenomys.
12. Dicrostonyx.
13. Fiber.
14. Lemmus.

PLATE III.

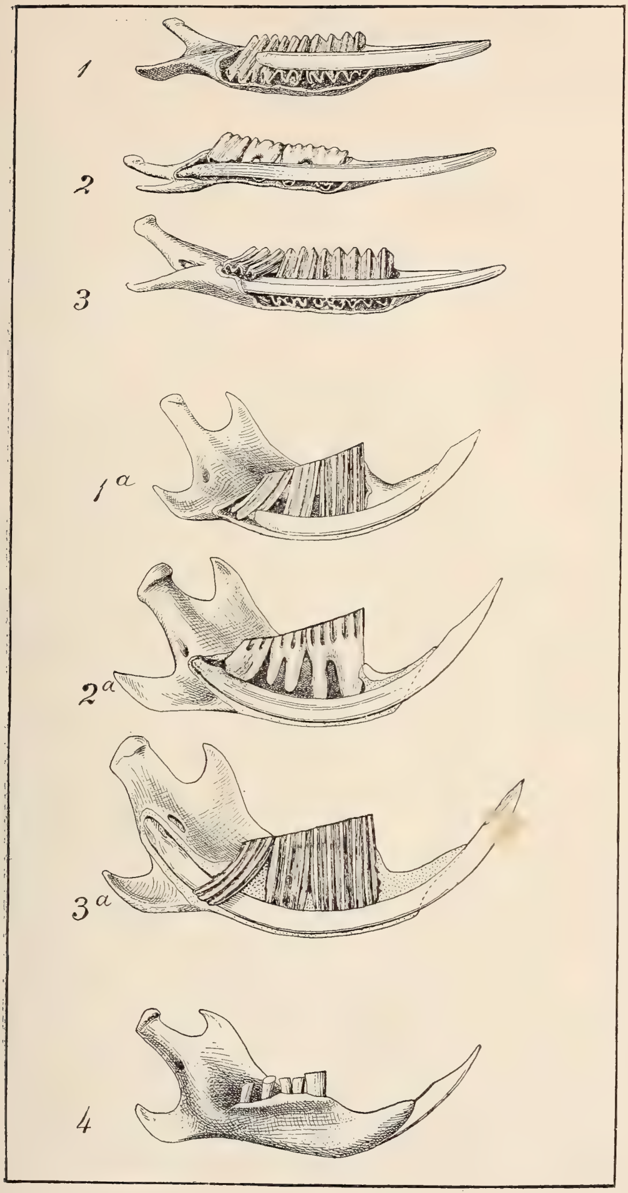
[Enlarged two and two-thirds times.]

FIG. 1. *Synaptomys cooperi.* Roan Mountain, North Carolina.
(No. 50865, U. S. Nat. Mus.)
- 1. Left mandible from beneath; bone cut away to expose roots of teeth.
- 1*a*. Left mandible from inner side; bone cut away to expose roots of teeth.

2. *Phenacomys oramontis* Rhoads. Mount Baker, British Columbia.
(No. 3562, collection of Gerrit S. Miller, jr.)
- 2. Left mandible from beneath; bone cut away to expose roots of teeth.
- 2*a*. Left mandible from inner side; bone cut away to expose roots of teeth.

3. *Microtus pennsylvanicus.* West Tisbury, Mass.
(No. 1885, collection of Gerrit S. Miller, jr.)
- 3. Left mandible from beneath; bone cut away to expose roots of teeth.
- 3*a*. Left mandible from inner side; bone cut away to expose roots of teeth.

4. *Evotomys gapperi.* Seekonk, Mass.
(No. 193, collection of Gerrit S. Miller, jr.)
- Left mandible showing effect of excessive wear on teeth.



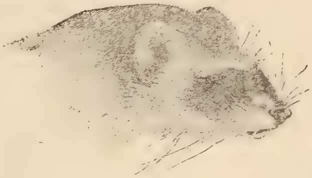
1. *Synaptomys.*
2. *Phenacomys.*
3. *Microtus.*
4. *Evotomys.*

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

NORTH AMERICAN FAUNA

No. 13

[Actual date of publication, October 16, 1897.]



REVISION OF THE NORTH AMERICAN BATS OF THE FAMILY VESPERTILIONIDÆ

BY

GERRIT S. MILLER, Jr.

Prepared under the direction of
Dr. C. HART MERRIAM
CHIEF OF DIVISION OF BIOLOGICAL SURVEY

WASHINGTON
GOVERNMENT PRINTING OFFICE
1897

LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF BIOLOGICAL SURVEY,
Washington, D. C., July 1, 1897.

SIR: I have the honor to transmit herewith, and recommend for publication, the manuscript of No. 13 of North American Fauna, comprising a monographic revision of the bats of the family *Vespertilionidæ* inhabiting North America north of Panama, by Gerrit S. Miller, jr. It is based mainly on material belonging to the Biological Survey, where the work has been done.

The Department is constantly in receipt of bats sent for identification and of letters of inquiry concerning these animals; but heretofore, owing to the chaotic state of the literature relating to this group and the uncertainty respecting the status of the various species, it has been impossible to answer such inquiries with any degree of certainty. The present paper is intended to remove these difficulties.

Respectfully,

C. HART MERRIAM,
Chief, Biological Survey.

Hon. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

Page.
Material 7
Changes in color of specimens preserved in alcohol 8
Sexual variation 8
Age variation 8
Geographic variation 9
Geographic distribution 10
Migration 10
Measurements 11
Illustrations 12
Nomenclature of North American Vespertilionidæ 12
  1. Generic and subgeneric names 12
  2. Specific and subspecific names 20
Lists of North American Vespertilionidæ 38
Descriptions 41

ILLUSTRATIONS.

PLATES.

1. Ears of *Myotis velifer, M. californicus, M. yumanensis, M. thysanodes, M. evotis, Nycticeius humeralis, Rhogeëssa gracilis, R. tumida, Corynorhinus macrotis townsendii, Euderma maculatum, Antrozous pallidus.*
   Uropatagia of *Rhogeëssa gracilis, R. tumida, Nycticeius humeralis.*
2. Uropatagia of *Myotis californicus, M. yumanensis, M. evotis, M. thysanodes, M. velifer.*
3. Wings of *Plecotus, Corynorhinus, Euderma,* and *Lasiurus.*

TEXT FIGURES.

1. Wings of *Vespertilio serotinus.*
2. Anterior part of rostrum of species of *Phyllostomatidæ* and *Vespertilionidæ.*
3. Muzzle of *Antrozous.*
4. Abnormal front teeth of *Antrozous.*
5. Skulls of *Antrozous.*
6. Teeth of *Antrozous.*
7. Muzzles of *Plecotus* and *Corynorhinus.*
8. Skulls of two subspecies of *Corynorhinus.*
9. Teeth of two subspecies of *Corynorhinus.*
10. Upper incisors of three specimens of *Corynorhinus.*
11. Skulls of *Myotis myotis, M. thysanodes,* and *M. nigricans* (top).
12. Skulls of *Myotis myotis, M. thysanodes,* and *M. nigricans* (side).
13. Ear of *Myotis subulatus, M. keenii, M. lucifugus,* and *M. alascensis.*
14. Teeth of *Myotis yumanensis, M. lucifugus, M. lucifugus longicrus, M. velifer.*
15. Teeth of *Myotis californicus, M. subulatus, M. evotis, M. thysanodes.*
16. Maxillary teeth of four specimens of *Myotis thysanodes.*
17. Abnormal premolar of *Myotis thysanodes.*
18. Skull of *Lasionycteris noctivagans.*
19. Teeth of *Lasionycteris noctivagans.*
20. Ear of *Pipistrellus subflavus* and *P. hesperus.*
21. Skull of *Pipistrellus hesperus* and *P. subflavus* (top).
22. Skull of *Pipistrellus hesperus* and *P. subflavus* (side).
23. Teeth of *Pipistrellus hesperus* and *P. subflavus.*
24. Skull of *Vespertilio bahamensis, V. fuscus,* and *V. serotinus* (top).
25. Skull of *Vespertilio bahamensis, V. fuscus,* and *V. serotinus* (side).
26. Teeth of *Vespertilio serotinus,* and four subspecies of *V. fuscus.*
27. Ear of *Lasiurus borealis* and *L. teliotis.*
28. Skull of *Lasiurus borealis* and *L. teliotis* (top).
29. Skull of *Lasiurus teliotis* and *L. borealis* (side).
30. Teeth of *Lasiurus teliotis* and *L. borealis.*
31. Skull of *Lasiurus cinereus.*
32. Teeth of *Lasiurus cinereus.*
33. Skull of *Dasypterus intermedius.*
34. Teeth of *Dasypterus intermedius.*
35. Skull of *Nycticeius humeralis.*
36. Teeth of *Nycticeius humeralis.*
37. Incisors of *Rhogeëssa* and *Nycticeius* (front).
38. Incisors of *Rhogeëssa* and *Nycticeius* (crowns).
39. Skull of *Rhogeëssa tumida.*
40. Teeth of *Rhogeëssa tumida* and *R. gracilis.*

No. 13. NORTH AMERICAN FAUNA. October, 1897.

REVISION OF THE NORTH AMERICAN BATS OF THE FAMILY VESPERTILIONIDÆ.

By Gerrit S. Miller, Jr.

Writers on American bats have published a large mass of facts concerning the distribution and comparative anatomy of members of the family *Vespertilionidæ*. Unfortunately, however, no work has yet appeared in which the numerous species by which this group is now known to be represented in North America[1] are treated from the standpoint of the systematic zoologist. In other words it has hitherto been impossible for anyone not thoroughly acquainted with the extensive and scattered literature of North American bats to identify specimens correctly. The present paper has been prepared with special reference to the long-felt want of a ready means to accomplish this object.

MATERIAL.

The greater part of the material on which this revision is based is contained in the collection of the Biological Survey of the U. S. Department of Agriculture. This collection of bats, which consists of more than 3,000 specimens, chiefly in alcohol, has been brought together during the past few years by the field naturalists of the Survey. In addition, the writer has examined the bats in the United States National Museum, the American Museum of Natural History, and several private collections, making a total of about 2,700 specimens of North American *Vespertilionidæ*. It is to be regretted that so few South American bats are contained in the museums of the United States that no definite conclusions can be reached concerning the relationships of several Mexican species to the forms occurring farther south. For this reason certain questions of nomenclature must for the present remain in a condition of uncertainty. It is also to be regretted that comparatively few well-prepared skins are available for comparison. Without good series of dry specimens it is impossible to determine the limits of individual variation in color, as conclusions of the most general kind only can be based on specimens that have been subjected to the action of alcohol. Series of bat skins as extensive as those by which most groups of small North American mammals are now represented will doubtless prove the existence of several well-marked geographic races in addition to those now recognizable.

---

[1] In the present paper the term North America is used to indicate the whole of the North American continent and the West Indies.

In the lists of specimens examined it has not been thought necessary to distinguish between those contained in the National Museum proper and those in the collection of the Biological Survey. Specimens from other collections, however, are always specially designated.

CHANGES IN COLOR OF SPECIMENS PRESERVED IN ALCOHOL.

Bats which have been kept in alcohol for a period of more than a few months become so altered in color that they furnish reliable characters of size and form only. The rate and amount of change appear to vary with different species as well as with the strength of the preservative fluid and the amount of exposure to light. I have seen two lots of specimens of one species collected at the same place and on practically the same date and supposedly treated in the same way, yet after six years' immersion in alcohol those in one bottle still retained essentially their normal color, as proved by comparison with skins collected at the same time, while those in another bottle were so bleached as to show scarcely a semblance of their original appearance.

While the details of the changes produced by alcohol are not known, it may be said that a gradual bleaching and ultimate entire loss of color is the general rule, though as a preliminary step browns are often very noticeably reddened. The subject is one that merits experimental study.

SEXUAL VARIATION.

The range of sexual variation in North American *Vespertilionidæ* is always slight and in many cases scarcely appreciable. For the most part it consists in the slightly greater average size of the females. Even this is often trifling or absent, as in the case of *Myotis lucifugus longicrus* from Nicasio, Cal., six males of which average: Total length, 95.1; tail vertebræ, 45.8; forearm, 37.8; ear, 11.8; tragus, 7.3; while six females from the same locality average: Total length, 96.3; tail vertebræ, 44.1; forearm, 37.3; ear, 12.1; tragus, 7.2. In general, however, it is necessary to take this factor into consideration when comparing specimens from widely separated localities. I know of no instances of constant sexual differences in color among North American *Vespertilionidæ*, and only one of differences in cutaneous structures, that of *Rhogeëssa gracilis*, in which the only known male has in each ear a distinct glandular swelling, absent in the two females that I have examined (see Pl. I, fig. 7).

AGE VARIATION.

Young bats when nearly full grown often present characters different enough from those of the adults to cause confusion in identification. The fur of such immature specimens is usually shorter and more woolly than that of the adults and the color darker and duller. The immature skull differs in size and form from that of the adult, but as the sutures disappear at an early age, it is often somewhat difficult to recognize.

I have found that the best guide to the age of those bats that I have studied is the condition of the finger joints. In specimens young enough to furnish unreliable characters these are always large and loosely formed, with epiphyses separate from the ends of the phalanges and metacarpals, both of which are distinctly enlarged for some distance from the joint (fig. 1 *a*). In adults the finger joints are small and compact, the epiphyses no longer visible, and the phalanges of essentially the same diameter throughout (fig. 1 *b*). These differences are equally apparent in alcoholic specimens and in dried skins.

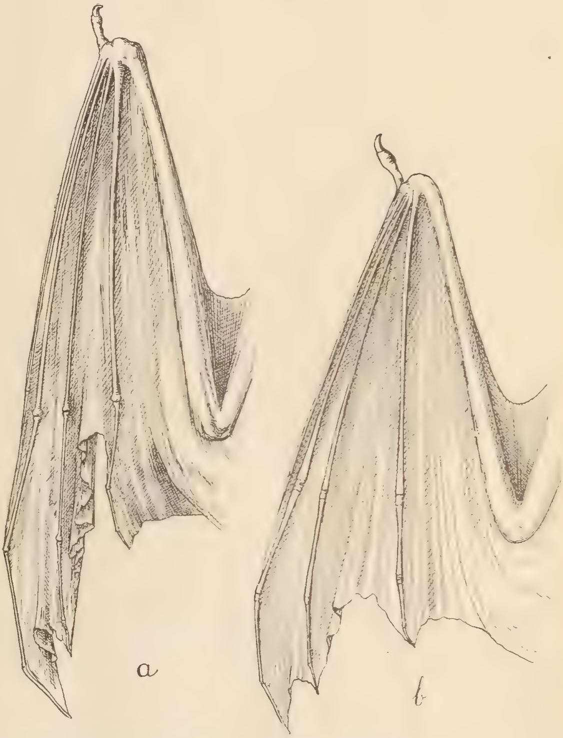


FIG. 1.—Wings of *Vespertilio serotinus*: *a*, adult; *b*, immature (natural size).

GEOGRAPHIC VARIATION.

As compared with other small mammals, bats show remarkably little geographic variation in size, proportions, or color. Thus breeding individuals of *Nycticeius humeralis* from Carlisle, Pa., Dismal Swamp, Virginia, and the extreme southern point of Texas are alike in color,[1] while in size they agree almost as closely as any three lots of specimens from one locality.[2] The only difference that can be found is a slight northward increase in size of the ears. Specimens of *Myotis lucifugus* from Washington, D. C., are not distinguishable from a series taken on Kadiak Island, Alaska, and skins of *Lasiurus cinereus* from Minnesota are exactly like others from southern California. While such constancy of characters in wide ranging species is unparalleled among American mammals, the only ones of which it is yet possible to speak with certainty, the explanation of the fact is probably very simple. Living throughout the warmer part of the day in cool, dark, and for the most part damp situations, bats, even in widely separated localities, are exposed to comparatively little variation in temperature. Feeding at a distance above the surface of the ground and during the hours between sunset and sunrise, when colors are scarcely distinguishable, they are practically freed from that necessity for protective coloration which binds the color of most mammals so closely to that of their surroundings. From this reduction in the force of two of the most powerful factors in the production of geographic variation—differences in temperature and need for protective coloration—the comparative constancy in the characters of bats naturally results.

---

[1] So far as can be ascertained from comparison of specimens in alcohol.

[2] See table of measurements on page 120.

GEOGRAPHIC DISTRIBUTION.

From the peculiar habits of bats it results that the ranges of these animals are less closely limited by life areas than in the case of most mammals. To be more accurate, the frequent dampness and usual low, even temperature of the retreats occupied by bats during the hot part of the day expose the animals to essentially similar conditions wherever they may be, so that a given region of like environment is much more extended geographically for a bat than for most other mammals.[1]

Therefore, although many species seemingly disregard the laws of geographic distribution, their independence is more apparent than real.

MIGRATION.

A factor which introduces much uncertainty into the study of the distribution of bats is the little understood migrations which some species are known to make. That many bats migrate is a well-established fact, but the extent to which migration affects the apparent distribution of species is not known.

Although there are probably earlier references to the subject, the first mention of bat migration that I have seen is by Dobson, in his Catalogue of the Chiroptera in the British Museum, published in 1878. In his remarks on the geographic distribution of *Pipistrellus abramus*, Dobson says: "Found during the summer months in the Palæarctic region throughout middle Europe; * * * evidently migrates northward, * * * as it has never been taken in Europe in winter" (p. 227). In 1888 Dr. C. Hart Merriam published evidence in the Transactions of the Royal Society of Canada (V, Section V, p. 85), which showed conclusively that two American bats, *Lasionycteris noctivagans* and *Lasiurus cinereus*, perform regular periodical migrations. No details of the extent or exact dates of the northward and southward movements could then be given further than that the known southern records of the hoary bat (South Carolina, Georgia, Bermuda Islands) were all during autumn and winter, and that the silver-haired bat occurred in spring and fall about the light-house on Mount Desert Rock, 30 miles off the coast of Maine, a treeless islet where bats were at other times unknown. In August and September, 1890 and 1891, I had an opportunity to watch the appearance and disappearance of three species of bats, *Lasionycteris noctivagans, Lasiurus borealis, and Lasiurus cinereus*, at Highland Light, Cape Cod, Massachusetts. The animals, which were not to be found during the early summer, suddenly became numerous shortly after the middle of August and remained abundant for about a month, when they as suddenly disappeared. The regularity with which this phenomenon occurred on the two successive years over which my observations extended shows that the migration of bats is probably as definite as to dates and paths as that of birds.[1]

---

[1] Analogous conditions are found in sphagnum bogs and heavy, damp woodlands, in which animals of northern affinities, such as shrews, lemmings, and red-backed mice, extend far south of the normal limit of their kind.

MEASUREMENTS.

For general purposes of identification, ten measurements are useful. These are: Total length, tail vertebræ, tibia, foot, forearm, thumb, longest finger, height of ear from meatus, width of ear, and height of tragus. The lengths of the separate phalanges of the fingers are important in special cases only.

The tables which accompany the descriptions of the different forms contain average measurements of specimens selected from as wide a range of localities as possible. Whenever the full complement of measurements is given, it is to be understood that all have been taken from alcoholic specimens by the writer. When the total length, length of tail, and the three measurements of the ear are omitted, the measurements have been taken from the dried skin. In a few cases the skin measurements are supplemented by the collector's measurement of total length and tail vertebræ. The use of specimens preserved in alcohol introduces a source of error in two measurements—total length and length of tail. According to the strength of the preservative fluid, both body and tail are to a varying degree shrunk or relaxed, so that considerable discrepancies in the averages of specimens taken at different localities by different collectors may result. In general, it is probable that these two measurements as given in the tables are a trifle shorter than they would have been if taken from fresh material.

It is unfortunate that detailed measurements of individuals can not be published, since averages are of use for comparison with averages only, and it often happens that a single specimen must be identified. Averages, moreover, give no indication of the normal range of individual variation at a particular locality.

---

[1] A detailed account of the migration of bats on Cape Cod was published in Science, N. S., V, No. 118, pp. 541-543, April 2, 1897.

ILLUSTRATIONS.

The illustrations in this paper are reproductions of pen-and-ink drawings made under my constant supervision by Mr. Frank Müller. Special difficulty has been encountered in obtaining satisfactory representations of the external ear and of the crowns of the teeth.

The ears of alcoholic specimens are generally sufficiently altered in form, by pressure and by the action of the preservative fluid, to retain only approximately the appearance which they had in the living animal. This is especially the case with such large-eared species as *Antrozous pallidus*, *Corynorhinus macrotis*, *Myotis evotis*, and others. In the impossibility of reproducing their original appearance, it has been thought best to represent the ears in a uniform but somewhat unnatural position, with the conch flattened and the external basal lobe turned outward. This will account for the apparently undue width of certain drawings.

The crown views of the teeth were first sketched with the aid of a camera lucida and afterwards corrected and finished by the use of hand lenses. The great difficulty in obtaining accurate and uniform results arose from the impossibility of keeping specimens in exactly comparable positions and from the considerable changes in outline resulting from every slight variation in the angle of vision. Therefore the drawings are not wholly satisfactory. They are published, however, in the belief that, such as they are, they may help to an understanding of the characters of the species.

NOMENCLATURE OF NORTH AMERICAN VESPERTILIONIDÆ.

To arrive at final conclusions in regard to the nomenclature of the *Vespertilionidæ* of North America, it will be necessary to consider in detail all names that have been based on those members of the group that inhabit the region in question, and also a few based on allied Old World species. The names may best be taken up alphabetically.

1. Generic and Subgeneric Names.

Adelonycteris H. Allen, **1892** (Proc. Acad. Nat. Sci., Phila., 1891, p. 466, Jan. 19, 1892), was proposed as a substitute for *Vesperus* Keys. & Blas., preoccupied in Entomology by *Vesperus* Latreille, 1829. The name is, however, a synonym of *Vespertilio* Linnæus, 1758, *Eptesicus* Rafinesque, 1820, and also of *Cnephæus* Kaup, 1829.

Aeorestes Fitzinger, **1870** (Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth., I, pp. 427–436), is a synonym of *Myotis* Kaup, 1829. The group included three South American species, *Myotis villosissimus*, *M. nigricans*, and *M. albescens*.

Antrozous H. Allen, **1862** (Proc. Acad. Nat. Sci. Phila., p. 248), is the only generic name based on *Vespertilio pallidus* Le Conte.

Atalapha Rafinesque, **1814** (Précis des Découv. et Travaux Somiologiques, p. 12), is clearly based on a Sicilian bat.[1] The use of the name for a genus confined to America is therefore impossible.

Brachyotus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 174–177), is a subgeneric name based on three European species of '*Vespertilio*' (*mystacinus*, *daubentonii*, and *dasycneme*) with ears shorter than head.

Cateorus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 162–163), a subgeneric name based on '*Vesperus*' *serotinus*, is a synonym of *Vespertilio* Linnæus.

Cnephæus Kaup, **1829** (Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., 1ster Theil, p. 103), is a generic name based on *Vespertilio serotinus* Schreber, a species congeneric with *Vespertilio fuscus* of America. The name is a synonym of *Vespertilio*.

Cnephaiophilus Fitzinger, **1870** (Sitzungsber. K. Akad. Wiss., Wien, LXII, Abth. I, p. 81), is a genus composed of very heterogeneous elements among which no type is mentioned. The species referred to it are *macellus* ('Borneo'), *pellucidus* ('S. E. Asia, Philippines'), *ferrugineus* ('Mittel-Amerika, Surinam'), and the North American *noctivagans*. Whether or not the name may be available for some of the other species, it certainly is not for the one which comes within the limits of the present paper, since this was already provided with the generic name *Lasionycteris*.

Comastes Fitzinger, **1870** (Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth. I, p. 565), is a synonym of *Myotis* Kaup, unless it may eventually be shown that the species on which it was based, *capaccinii*, *megapodius*, *dasycneme* and *limnophilus*, are subgenerically distinct from *Myotis myotis*.

Corynorhinus H. Allen, **1865** (Proc. Acad. Nat. Sci. Phila., p. 173), proposed as a generic name for *Plecotus macrotis* Le Conte and *P. townsendi* Cooper, is the only available name for the group of which *Corynorhinus macrotis* is the only known species.

Dasypterus Peters, **1871** (Monatsber. K. Akad. Wiss., Berlin, 1870, p. 912, published 1871), was established as a subgenus of *Atalapha* (=*Lasiurus*) to contain the species *intermedia*, *egregia*, *ega*, and *caudata*. It has recently been raised to full generic rank by Dr. Harrison Allen.

Eptesicus Rafinesque, **1820** (Annals of Nature, p. 2), originally contained two species, *E. melanops* and *E. mydas.*[1] *Eptesicus melanops* is without doubt the *Vespertilio fuscus* of Beauvois. *E. mydas*, however, can not be identified (see p. 32). The first species must therefore be taken as the type. Since this species is congeneric with *Vespertilio murinus* Linnæus (= *Vesperugo discolor* Natterer), the type of the genus *Vespertilio*, the name *Eptesicus* is a synonym of *Vespertilio.*

---

[1] II. G. ATALAPHA (Chauve-souris). Incisives nulles aux deux mâchoires, canines et machelières aigues: aucune crête sur le nez, queue presqu'entièrement unie aux membranes.

2. *Atalapha sicula*.—Oreilles de la longueur de la tête, et auriculées, une verrue sous la lèvre inférieure; corps roux brunâtre en dessus, roux cendré en dessous, ailes et museau noirâtre, queue saillante par une pointe obtuse.—Obs. J'ai observé cette espèce en Sicile, elle diffère de l'*Atalapha americana* (*Vespertilio noreboracensis* Lin.), autre espèce du même genre, par ses deux premiers et son dernier caractère.

Euderma H. Allen, **1892** (Proc. Acad. Nat. Sci. Phila., 1891, p. 467, published Jan. 19, 1892), is the tenable name for the genus of which *Histiotus maculatus* J. A. Allen is the type and only known species.

Histiotus Gervais, **1855** (Exped. Comte de Castelnau Am. du Sud, Zool., Mammif., p. 77, Pl. XII), was based on the South American *Plecotus velatus* of Geoffroy. *Euderma maculatum* was originally described as a member of this genus, the name of which has not otherwise appeared in the literature of North American *Vespertilionidæ.*

Hypexodon Rafinesque, **1819** (Journal de Physique, de Chimie, d'Histoire naturelle et des Arts, LXXXVIII, p. 417), can not be identified with any known group of bats. The characters which Rafinesque assigns to the type species[2] may be those of a mutilated and distorted specimen of some of the small species of *Nycticeius*, *Pipistrellus*, or *Myotis.*

Hypsugo Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169), is a synonym of *Pipistrellus* Kaup. It was based on '*Vesperugo*' *maurus* Blasius and '*V.*' *kraschenikowii* Eversmann.

Isotus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 177–179), is a subgeneric name based on two European species of '*Vespertilio*' (*nattereri* and *ciliatus*) which have the ear about equal in length to the head. It is of course a synonym of *Myotis* Kaup, 1829, and of *Selysius* Bonaparte, 1841.

Lasionycteris Peters, **1865** (Monatsber. K. Preuss. Akad. Wiss., Berlin, 1865, p. 648), is the first name proposed for the genus of which *Vespertilio noctivagans* Le Conte is the only known species.

Lasiurus Gray, **1831** (Zoological Miscellany, No. 1, p. 38), is the first name based on the bats of the American genus commonly but wrongly called *Atalapha*. It was introduced as follows: "The bats, the *Vespertiliones* of Geoffroy, might for convenience be divided into three genera, the true bats, *Vespertilio* * * *, the *Pachyotus* * * *, and the hairy tailed species of America (*Lasiurus*)." As the only hairy-tailed American bats known in 1838 were members of the modern genus *Lasiurus*, this brief statement may be taken as a definite indication of the author's meaning. In 1838 Gray referred the species *pruinosus* (=*cinereus*), *lasiurus* (=*borealis*), and *blossevillei* (=*borealis*, *fide* Dobson) to the group, which he then regarded as a subgenus or section of *Scotophilus* (Mag. Zool. & Bot., II, p. 498, Edinburgh, 1838).

---

[1] The original diagnosis of the genus *Eptesicus* is as follows:

"I. N. G. EPTESICUS. Four acute fore-teeth to the upper jaw, in two equal pairs, separated by a great interval and a large flat wart, each pair has two unequal teeth, the outside tooth is much larger and unequally bifid, the outside one much larger, inside tooth small and entire. Six fore-teeth to the lower jaw, equal very small, close and truncate. Canine teeth very sharp, curved and long. Grinders unequally trifid. Snout plain, nose without appendages. Ears separated, auriculated. Tail mucronate.—This genus appears to differ from all those of Geoffroy and Cuvier, among the extensive tribe of Bats. The name means house-flyer."

[2] 1. Nouveau genre. HYPEXODON. (Chauve-souris.) Museau nu; narines rondes, saillantes; incisives supérieures nulles, 6 inférieures émarginées, une verrue à la base extérieure des canines inférieures. Queue engagée dans la membrane. Le reste comme le genre *Vespertilio.*—I espèce *H. mystax*, entièrement fauve, dessus de la tête brun, ailes et membranes noires, queue mucronée, des moustaches, oreilles brunes auriculées, nervures intérieures et transversales; longueur totale, 3 pouces, dont la queue 2 pouces. En Kentucky.

Marsipolæmus Peters, **1872** (Monatsber. k. Preuss Akad. Wiss., Berlin, p. 260), was proposed in a subgeneric sense for a Mexican bat, *Vesperus albigularis* Peters, about the size of *Vespertilio fuscus*, with the dentition of that species, but with the outer border of the ear continuous with a fold of skin which extends back from the corner of the mouth, under and behind which a distinct pocket is formed. I have never seen this bat, and am unable to say what value is to be placed on the characters described. (See p. 104.)

Meteorus Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169), is a synonym of *Vespertilio* Linnæus. It was proposed as a subgenus of '*Vesperus*' to include the species *nilssoni*, *discolor*, *savii*, *leucippe*, and *aristippe*.

Myotis Kaup, **1829** (Skizzirte Entw. Gesch. u. Natürl. Syst. der Europ. Thierw., 1ster Theil, p. 106), is the first name based on the large, long-eared, thirty-eight-toothed bat wrongly called *Vespertilio murinus* by Schreber.[1] It is therefore the tenable name for the genus of which this animal is the type. As the *Vespertilio murinus* of Schreber is not the *Vespertilio murinus* of Linnæus, another specific name must be applied to the former. The name *myotis* Bechstein[2] is available for this purpose. Hence the *Vespertilio murinus* of Schreber and of European writers in general must stand as *Myotis myotis* (Bechstein).

Nannugo Kolenati, **1856** (Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 169–172), is a synonym of *Pipistrellus* Kaup, 1829. It was proposed as a subgenus of '*Vesperugo*' to include the European species *pipistrellus*, *kuhlii*, and *nattereri*.

Noctula Bonaparte, **1837** (Iconografia Fauna Italica, I, fasc. XXI, under *Vespertilio alcythoe*), based on *Vespertilio serotinus* Schreber is a synonym of *Vespertilio* Linnæus.

Nycticeius Rafinesque, **1819** (Journal de Physique, de Chimie, d'Histoire Naturelle et des Arts, LXXXVIII, p. 417), contained two species,

---

[1] Kaup says: "Fledermäuse von riesenmässiger Grösse, mit nacktem Gesicht, getrennten, kopfslangen Ohren, langen lanzettförmigen Ohrendeckeln, und 38 Zähnen."

[2] *Vespertilio myotis* Bechstein, Gemeinnütz. Naturgesch. Deutschlands, Bd. I, p. 1145, 1791 (*fide* Blasius).

N. humeralis Raf. and *N. tesselatus* Raf. Nothing in the description[1] indicates which of these the author considered as the type. *Nycticeius tesselatus* Raf. is *Lasiurus borealis* (Müller), and *N. humeralis* may with some degree of probability be identified with the small brown bat more generally known as *Nycticejus crepuscularis* Le Conte.[2] There is certainly nothing in the diagnosis of the genus or in the description of *Vespertilio humeralis* previously published in the American Monthly Magazine that precludes this possibility, while the size, the number of incisors, and the naked uropatagium point directly toward it. As *borealis* was removed to the genus *Lasiurus* by Gray in 1838, *humeralis* becomes the type of *Nycticeius*. The orthography of this name has had several emendations, as *Nycticeus*, *Nycticejus*, *Nycticea*, and *Nycticeyx*.

Nyctilestes Marsh, **1872** (Amer. Journ. Sci. & Arts, 3d ser., IV, p. 215), is a fossil genus based on part of a lower jaw and molars from Eocene or Lower Miocene strata near Henrys Fork, Wyoming. The remains present no characters to distinguish them generically from *Vespertilio*. Only one species, *Nyctilestes serotinus*, has been described.

Nyctitherium Marsh, **1872** (Amer. Journ. Sci. & Arts, 3d ser., IV. p. 127), is a genus based on the fragments of two lower jaws found with teeth in place, from Tertiary strata at Grizzly Buttes, Wyoming. The original description indicates no characters by which these teeth may be distinguished from those of small species of *Pipistrellus* or *Vespertilio*.

Nystactes Kaup, **1829** (Skizzirte Entw.-Gesch. u. Natürl. Syst. der Europ. Thierw., 1ster Theil, p. 108), based on *Vespertilio bechsteinii* Leisler is strictly synonymous with the same author's *Myotis*.[3]

Pachyotus Gray, **1831** (Zool. Misc., No. 1, p. 38), was first used as the name for a genus made by the combination of *Nycticeius* and *Scotophilus*. Later (Mag. Zool. & Bot., II, p. 498, 1838) Gray transferred it to *Vespertilio villosissimus* Geoffroy in a subgeneric sense. The name is of course untenable.[4]

Pipistrellus Kaup, **1829** (Skizzirte Entw.-Gesch. u. Natürl. Syst. der Europ. Thierw., 1ster Theil, p. 98). This name was based on *Vespertilio pipistrellus* Schreber, a species strictly congeneric with the '*Vesperugo*

---

[1] 2. NYCTICEIUS. (Chauve-souris.) Diffère du genre précédent [*Hypexodon*] par 2 incisives supérieures séparées par un grand intervalle, accolées aux canines et à crénelures aiguës, 6 incisives inférieures tronquées, point de verrues aux canines.—Ce genre contient au moins 2 espèces, *N. humeralis* et *N. tesselatus*, que j'ai déjà décrits dans l'*American Monthly Magazine*, sous la dénomination générique *Vespertilio*, avec plusieurs autres nouvelles espèces de ces contrées.

[2] See Thomas, Ann. & Mag. Nat. Hist., 1891, 528.

[3] Kaup says: "Fledermäuse mit sehr langen getrennten Ohren, langem zugespitzem Ohrendeckel, 38 Zähnen und spitzmausähnlichem Rüssel."

[4] The original reference is as follows: "The bats, the *Vespertiliones* of Geoffroy, might for convenience be divided into three genera, the true bats, *Vespertilio*, with thin ears and membranes and a hairy face, the *Pachyotus*, with thick ears and membranes and bald swollen cheeks, including the genera *Nycticejus* and *Scotophilus*, and the hairy-tailed species of America (*Lasiurus*)."

georgianus' of the United States. It antedates the name *Vesperugo* by exactly ten years.

Plecotus Geoffroy, **1818**[1] (Description de l'Égypte, Mammifères, p. 112), included three species, 'l'Oreillard de Daubenton,' 'la barbastelle,' and a new species from Timor.[2]

As no American bats are congeneric with the species originally included in this genus, the name can not be used for any of the genera now under consideration. It has been applied to the species of *Corynorhinus.*

Rhogeëssa H. Allen, **1866** (Proc. Acad. Nat. Sci. Phila., p. 285), was proposed as a genus to contain the species *R. parvula* H. Allen and *R. tumida* H. Allen. The group, whose validity has not been questioned, has received varying treatment at the hands of different writers. Dobson placed it as a subgenus under '*Vesperugo*,' but Thomas has recently pointed out its close relationship to *Nycticeius.* The latter disposition appears to be the more natural.

The name has been amended to *Rhogöessa* by Marschall (Nomenclator Zoologicus, Mamm., p. 11, 1873).

Scotophilus Leach, **1821** (Trans. Linn. Soc. London, XIII, pt. 1, p. 69), type *S. kuhlii* Leach, is a genus peculiar to the Old World, where it apparently replaces the *Lasiurus* of America. It is mentioned here merely because the name has been used for the North American species of *Lasiurus*, *Vespertilio*, *Lasionycteris*, and *Pipistrellus* at times when these bats were supposed to be congeneric with Old World species.

Selysius Bonaparte, **1841** (Iconografia Fauna Italica, I, Introduzione [p. 3]), is a synonym of *Myotis* Kaup, 1829. It was based on the common European *Vespertilio mystacinus* of Leisler.

Synotus Keyserling and Blasius, **1839** (Wiegmann's Archiv f. Naturgeschichte, 5ter Jahrgang, Bd. I, pp. 305, 306), was based on the barbastelle, a European bat representing a genus not known to occur in America. The name, however, has been applied to the American genus afterwards called *Corynorhinus.* It is antedated by *Barbastella* Gray, 1821 (London Medical Repository, XV, p. 309. Type *Vespertilio barbastellus* Schreber).

Taphozous Geoffroy, **1818**[1] (Description de l'Égypte, Mammifères, p. 113), based on 'Le lerot-volant' and 'le *V. lepturus*,' which are without representatives in America. The red bat (*Lasiurus borealis*) was, however, included in this genus by Godman under the name *Taphozous rufus.*[3]

---

[1] See Sherborn, Proc. Zool. Soc. London, 1897, p. 288.

[2] Dents incisives $\frac{4}{6}$; canines $\frac{2}{2}$; molaires $\frac{5-5}{6-6}$. Nez *simple et saillant;* chanfrein *large et métplat.* Oreilles *plus grandes* que la tête, et réunies; oreillon intérieur. Membrane interfémorale étendue et à angle saillant. Queue longue et toute entière enveloppée.

Obs. Les trois espèces de ce genre sont, l'oreillard de Daubenton, la barbastelle et une nouvelle espèce de Timor.

[3] Fauna Americana, p. 23, 1825.

Fitzinger[1] refers to a '*Taphozous brachmanus* Godman' among the synonyms of *Lasiurus 'rufus'* (=*borealis*). This name, however, I have been unable to find in any of Godman's writings.

Vesperides Coues, **1875** (in Coues and Yarrow, Zool. of Wheeler's Exped., p. 83), was proposed as a subgenus of *Vespertilio* based on *Vespertilio noctivagans* Le Conte. The name is antedated by *Lasionycteris* Peters, 1865.

Vespertilio Linnæus, **1758** (Syst. Nat., 10th ed., I, p. 31), contained seven species: *vampyrus*, *spectrum*, *perspicillatus*, *spasma*, *leporinus*, *auritus*, and *murinus*. These have all been removed to other genera, as follows: *vampyrus* to *Pteropus* in 1762 (Brisson, Regn. Anim., ed. II, pp. 13, 153), *leporinus* to *Noctilio* in 1766 (Linnæus, Syst. Nat., 12th ed., p. 88), *spasma* to *Megaderma* in 1810 (Geoffroy, Ann. Mus. d'Hist. Nat., XV, p. 197), *auritus* to *Plecotus* in 1818 (Geoffroy, Descript. de l'Égypte, Mammifères, p. 112), *murinus*[2] to *Eptesicus* in 1820 (Rafinesque, Annals of Nature, 1820, p. 2), *perspicillatus* to *Artibeus* in 1821 (Leach, Trans. Linn. Soc. London, XIII, p. 75), and *spectrum* to *Vampyrus* in 1821 (Leach, Trans. Linn. Soc. London, XIII, p. 79).

The only European species are *auritus* and *murinus*, one of which must therefore become the type of the genus. The species *auritus* was removed to the genus *Plecotus* by Geoffroy in 18 8, leaving *murinus* as type of the genus *Vespertilio*. The *Vespertilio murinus* of Linnæus is, however, a totally different animal from the bat afterwards described under the same name by Schreber. To understand the case fully it is necessary to go back to the first and second editions of Linnæus's Fauna Suecica. In the first he records only one bat, the 'Läderlapp,' 'Flädermus' or 'Nattblacka,' *Vespertilio caudatus, naso oreque simplici* (No. 18, p. 7, 1746). In the second edition he mentions two, *V. caudatus, naso oreque simplici, auriculis duplicatis, capite majoribus*, and *V. caudatus, naso oreque simplici, auriculis capite minoribus* (No. 2, pp. 1, 2, 1761). In the tenth edition of the Systema Naturæ these had been given binomial names, *Vespertilio auritus* and *V. murinus*, respectively. The account of the teeth of the latter in the second edition of Fauna Suecica is as follows:[3]

> Dentes primores superiores 6, acuti distantes.
> inferiores 4, acuti contigui.
> Laniarii superiores 2, anteriore majore.
> inferiores 3, antico maximo.
> Molares utrinque 3, tricuspidati.

---

[1] Sitzungsber. K. Akad. Wiss. Wien, LXII, 1ste Abth., p. 402, 1870.

[2] Although Rafinesque did not actually place the species *murinus* in the genus *Eptesicus* he based the latter on a strictly congeneric form.

[3] In the first edition the dental formula is the same, except that the lower incisors are said to be five in number, an error corrected in the second edition.

It therefore appears that the *Vespertilio murinus* of Linnæus is a bat with ears shorter than the head, and with the dental formula:

$$i, \frac{2-2^1}{3-3}; \ c, \frac{1-1}{1-1}; \ pm, \frac{1-1}{2-2}; \ m, \frac{3-3}{3-3} = 32.$$

The only common Scandinavian bats which combine these characters are the two usually known as *Vesperugo nilssoni* and *Vesperugo discolor*. To these strictly congeneric European species and their exotic representatives the generic name *Vespertilio* must be applied, regardless of its long misuse for a different genus.

The current misidentification of Linnæus's *Vespertilio murinus* has been recognized by at least three writers on European bats, Nilsson, Blasius, and Lilljeborg. Nilsson[2] discusses the matter at considerable length and arrives at the conclusion that the name *murinus* must be substituted for *discolor*, while the bat commonly known as *murinus* must take the specific name *myotis* Bechstein. As this author unites the genera '*Vesperugo*' and '*Vespertilio*,' he has nothing to say in regard to the validity of the generic names used by Keyserling and Blasius.

Blasius[3] regarded Nilsson's identification of *Vespertilio murinus* as doubtful, though he admitted that the animal described by Linnæus under that name could not have been the one generally called *Vespertilio murinus* by European authors at large. He therefore reasoned that Linnæus's name might be disregarded as undeterminable and in no way invalidating Schreber's later application.

Lilljeborg alone questioned the tenability of the generic name *Vespertilio* for the thirty-eight-toothed bats of Europe.[4] He says:

> * * * As regards modifying the Linnæan generic name *Vespertilio*, it may be urged that Linnæus did not include in it any of the species referred to it by Keyserling and Blasius. Further, it would have been more correct to apply the name *Vespertilio* to the preceding genus ['*Vesperugo*'], since one of the species included in the genus by Linnæus (*Vespertilio murinus*) agrees, in all important characters at least, with the genus mentioned, as shown above. As, however, the modification of the name introduced by Keyserling and Blasius has become time-sanctioned, it will be retained, although we consider the objections against it reasonable.[5]

Vesperugo Keyserling and Blasius, **1839** (Wiegmann's Archiv f. Naturgesch., 5ter Jahrgang, Bd. I, p. 312), was proposed as a genus to contain the following species up to that time commonly associated with *Vesper-*

---

[1] In Linnæus's statement the figures 4 and 6 are evidently transposed.

[2] Skandinavisk Fauna, I, Däggdjuren, 2d ed., 1847, pp. 17–20.

[3] Naturgesch. d. Säugethiere Deutschlands, pp. 74, 84, 1857.

[4] Sveriges och Norges Ryggradsdjur, I, Däggdjuren, p. 144, footnote, 1874.

[5] * * * I afseende på tillämpningen här af det Linneanska genus-namnet *Vespertilio*, kan deremot invändas, att Linné icke uti detta genus upptagit en enda af de arter, som Keyserling & Blasius derunder beskrifvit, och att det hade varit rättare, att använda detta namn för föregående slägte ['*Vesperugo*'], emedan en af de af Linné uti sl. *Vespertilio* upptagna arterna—*Vespertilio murinus* Lin.—åtminstone till hufvudsaklig del, enligt hvad ofvan blifvit anfördt tillhör nämde slägte. Da emellertid den af Keyserling & Blasius införda tillämpningen af namnet vunnit häfd, vilja vi bibehålla den, ehuru vi anse invändningen vara befogad.

tilio: serotinus, discolor, nilssoni, savii, leucippe, aristippe, noctula, leisleri, kuhlii, albolimbatus, nathusii, and *pipistrellus*. The first six were placed in the new subgenus *Vesperus*, the others in the subgenus *Vesperugo*. Hence the type must be a member of the second group. This group, however, contains two modern genera, the first represented by the species *noctula* and *leisleri*, the second by *kuhlii*, '*albolimbatus*' (=*kuhlii*, *fide* Dobson), '*nathusii*' (=*abramus*, *fide* Dobson), and *pipistrellus*. These had already been named *Pterygistes* and *Pipistrellus*, respectively, by Kaup in 1829. Hence *Vesperugo* is untenable in any connection.

Vesperus Keyserling and Blasius, **1839** (Wiegmann's Archiv f. Naturgesch., 5ter Jahrgang, Bd. I, p. 313), proposed as a subgenus of '*Vesperugo*' to include the species *serotinus*, *discolor*, *nilssoni*, *savii*, *leucippe*, and *aristippe*, is antedated by *Cnephæus* Kaup, 1829, *Eptesicus* Rafinesque, 1820, and *Vespertilio* Linnæus, 1758. It is moreover preoccupied in Entomology by *Vesperus* Latreille, 1829.

2. Specific and Subspecific Names.

Affinis (Vespertilio). H. Allen, Monogr. Bats N. Am., p. 53, **1864**. The type of Dr. Harrison Allen's *Vespertilio affinis*, now in the United States National Museum, proves to be a typical example of *Myotis lucifugus*. It is therefore in no way related to the *Vespertilio nitidus* or V. *albescens* of Dr. Allen's second monograph.

Albescens (Vespertilio). E. Geoffroy, Ann. Mus. d'Hist. Nat., Paris, VIII, p. 204, **1806**. This is a South American species of *Myotis*, probably closely related to *M. velifer* (J. A. Allen). The measurements given by Azara and quoted in the original description are: Total length, 80 mm.; tail, 33; extent of wings, 235; ear, 14. The name *albescens* has been used by Dr. Harrison Allen for *Myotis yumanensis*, *M. evotis*, *M. californicus* ('*Vespertilio albescens melanorhinus*'), *M. velifer*, *M. thysanodes* (under *M. velifer*), and *M. lucifugus* ('*Vespertilio albescens affinis*'), which he unites as subspecies.

Albigularis (Vesperus). Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 260, **1872**. *Vespertilio albigularis* (Peters) is the type of the subgenus *Marsipolæmus*. The characters given in the original description indicate a well marked species, with which, however, I am wholly unacquainted. The type was collected in Mexico.

Alleni (Rhogeëssa). Thomas, Ann. & Mag. Nat. Hist., 6th ser., X, p. 477, **1892**. This is the only name for this species.

Americana (Atalapha). Rafinesque, Précis des Decouv. Somiologiques, p. 12, **1814**. This is a synonym of *Lasiurus borealis* (Müller), though properly speaking the name is a nomen nudum (see p. 106).

Arquatus (Vespertilio). Say, Long's Expedition to the Rocky Mountains, I, p. 167, footnote, **1823**. The description clearly indicates *Vespertilio fuscus* Beauvois.

Auduboni (Vespertilio). Harlan, Featherstonehaugh's Monthly American Journal of Geology and Natural History, I, p. 220, Pl. II, November, **1831**. Both description and plate indicate the silver-haired bat.

Austroriparius (Vespertilio lucifugus). Rhoads, Proc. Acad. Nat. Sci. Phila., p. 227, May, **1897**. *Vespertilio lucifugus austroriparius* Rhoads is a synonym of *Myotis lucifugus* (Le Conte). The type, a two-thirds grown young from Tarpon Springs, Florida, shows numerous characters by which it may be distinguished from northern adults, but the full grown topotypes are, as originally determined by Dr. Harrison Allen (see Rhoads, l. c.), indistinguishable from northern specimens of *lucifugus* that have been immersed in alcohol for a similar period. Even if it were assumed that the Tarpon Springs bat differed in some way not now discoverable from the '*lucifugus* of North Carolina and northward,' there could be little doubt that the southern form was the one originally described by Le Conte. (See page 63).

Bellii (Scotophilus). Gray, List Spec. Mamm. Brit. Mus., p. 30, **1843**. *Scotophilus bellii* Gray is a nomen nudum probably based on one of the West Indian forms of *Vespertilio fuscus*. Gray's account is as follows: "BELL'S BAT. SCOTOPHILUS Bellii. *a* In spirits. West Indies.—Presented by Thomas Bell, Esq., F. R. S."

Borealis (Vespertilio). Müller, Natursyst. Suppl., p. 21, **1776**. Müller's *Vespertilio borealis* is the first name based on the red bat, *Lasiurus borealis*.

Brevirostris (Vespertilio). Maximilian, Wiegmann's Archiv. f. Naturgeschichte, 1861, Bd. I, p. 195. *Vespertilio brevirostris* of Maximilian is probably *Myotis lucifugus* (Le Conte). The original measurements are: Total length, $3''$; extent, $9''\,4'''$; ear from crown, $5\frac{1}{2}'''$; tragus, $1\frac{1}{3}'''$.

Calcaratus (Vespertilio). Rafinesque, American Monthly Magazine, III, p. 445, **1818**. No known bat agrees with the description of Rafinesque's *Vespertilio calcaratus*, which is as follows: "Tail one-third, body dark brown above, dark fallow beneath, wings black, shafts rose-coloured, a spur at the inner side of the elbow, hind feet black. Length 4 inches, breadth 12."

Californicus (Vespertilio). Aud. & Bachm., Journ. Acad. Nat. Sci. Phila., VIII, Pt. II, p. 285, **1842**. This is the earliest name based on the small western bat commonly known as *Vespertilio nitidus* H. Allen. The original description is as follows:[1]

> *V. californicus* (Californian bat).—V. fusco lutescens, vellere longo et molli; trago longitudine dimidium auris excedente.
>
> *Californian bat.*—With long silky hairs; tragus more than half the length of the ear; color light yellowish brown.
>
> *Description.*—Anterior upper fore teeth bilobate. Head small; nose sharp; *ears of moderate size,* erect, rather narrow, and pointed. *Tragus linear, attenuated.* Wings of moderate length, which together with the ears are naked. *Interfemoral membrane with a few scattered hairs; feet small;* nails slightly hooked. Tail projecting a little beyond the interfemoral membrane.
>
> *Color.*—The pelage, *which is unusually long for the size of the body,* and very soft and glossy, is, on the upper surface, *dark plumbeous from the base, and broadly tipt with*

---

[1] I have italicized statements specially applicable to '*V. nitidus.*'

light yellowish brown; on the under surface the color is a little darker, owing to the outer extremities of the hairs being more narrowly edged with the prevailing color on the back, exhibiting the darker shades beneath. The ears and tragus are blackish—the nose, chin, wings, and interfemoral membrane dark brown.

Hab.—We have obtained but a single specimen, which was captured at California.

Dentition.—Incisors $\frac{2-2}{6}$. Canines $\frac{1-1}{1-1}$.

Dimensions.—Length of head and body, 1 inch 7 lines [40 mm.]; length of tail, 1 inch 5 lines [35.8]; length of spread, 7 inches 6 lines [190]; height of ear posteriorly, 3 lines [6.35]; height of tragus, 2 lines [3.8].

The only other small bats known to occur in California are *Pipistrellus hesperus*, *Myotis thysanodes*, *M. yumanensis*, *M. evotis*, and *M. lucifugus longicrus*. That *Vespertilio californicus* can not be *Pipistrellus hesperus* is shown by the description of the tragus. From *Myotis thysanodes* it is separated by its small size and unfringed interfemoral membrane; from *M. yumanensis* by its small feet; from *M. evotis* by its short ears, and from *M. lucifugus longicrus* by its light color and small size. *Myotis thysanodes* and *M. lucifugus longicrus* are moreover comparatively rare bats in California, while '*Vespertilio nitidus*' is one of the most common and universally distributed species.

Carolii (Vespertilio). Temminck, Monographies de Mammal., II, p. 237 (13me Monogr.), **1835-41.** The *Vespertilio carolii* of Temminck is without doubt *Myotis lucifugus* (Le Conte). That it is a *Myotis* is shown by the number of teeth, six molars in each jaw, while that it is not *M. subulatus*, the only other species known to occur in the vicinity of Philadelphia or New York, is shown by the short ear, 11.5 mm. in length.[1]

Carolinensis (Vespertilio). Geoffroy, Ann. du Mus. d'Hist. Nat., Paris, VIII, p. 193, **1806.**[2]

This species is *Vespertilio fuscus* Beauvois. Dr. Harrison Allen in

---

[1] The essential part of the original description is as follows:

"Taille et formes de notre pipistrelle, mais les oreilles plus longues. * * * oreilles médiocres, ovoïdes, un peu découpées à leur bord extérieur, sans lobe ou prolongement en avant; tragus en feuille de saule * * *. Dents incisives 4 par paire en haut et 6 en bas; molaires 6 partout; les deux premières fausses molaires de la mâchoire supérieure très petites, courtes et pointues.

"Pelage bicolore partout. Joues, côtes du cou et toutes les parties supérieures d'un brun-roussâtre à base des poils noirs; en dessous d'un blanc jaunâtre à la pointe et brun-foncé à la base * * *.

"Longueur totale 3 pouces 5 lignes, dont la queue prend 1 pouce 4 lignes; envergure 8 pouces 6 lignes; antibrachium 1 pouce 4 lignes; hauteur de l'oreille depuis le crâne jusqu'au bout 5 lignes; * * *.

"*Patrie.* L'Amérique septentrionale, dans les environs de Philadelphie et de New-York."

[2] The original description is as follows:

"2. *Vesp*[*ertilio*] *carolinensis.* Le vespertilion de la Caroline est moins grand que le précédent ['*V. murinus*'], mais d'ailleurs il lui ressemble beaucoup. Il a ses oreilles et oreillons de même forme et de même dimension relative; son poil est aussi de deux couleurs, cendré-noirâtre d'abord et brun-marron à la pointe. L'extrémité des poils est en dessous d'un jaune tirant sur le ventre; enfin les oreilles sont garnies de poils dans presque la moitié de leur longueur, et la queue a une petite portion qui n'est pas enveloppée par la membrane interfémorale. Ces considérations réunies à celles

his recent monograph has applied the name *carolinensis* to the Georgian bat (*Pipistrellus subflavus*), but there is no reason to doubt that Geoffroy's animal was the large brown bat. The head and skull are both figured, the former on Pl. I, the latter on Pl. II. These are only a trifle smaller than the head and skull of *Vespertilio serotinus* figured on the same plates, and very much larger than the figures of the head and skull of *Pipistrellus pipistrellus*, a species of about the same size as *P. subflavus.* The teeth are very indistinctly shown in the figure, but in the two copies which I have examined[1] I can find no indication of the second upper premolar of *Pipistrellus.*

Chrysonotus (**Vespertilio**). J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., VIII, p. 240, November 21, **1896**. *Vespertilio chrysonotus* J. A. Allen, from Kinney Ranch, Wyoming, is a pale example of *Myotis evotis* (H. Allen), with mutilated tail. (See p. 80.)

Ciliolabrum (**Vespertilio**). Merriam, Proc. Biol. Soc. Washington, IV, p. 1, **1886**. *Vespertilio ciliolabrum*, Merriam, is the only name based on the pallid race of *Myotis californicus* inhabiting the plains of South Dakota, Kansas, and Texas. The type was taken at Banner, Kansas.

Cinereus (**Vespertilio**). Beauvois, Catalogue Raisonné du Museum de Mr. C. W. Peale. Philadelphie, p. 18, **1796**. *Vespertilio cinereus* Beauvois (originally misspelled *linereus*) is the first name based on the hoary bat, *Lasiurus cinereus.* The description is so detailed and accurate as to leave no doubt as to the animal that Beauvois had in mind.[2] The type came from Pennsylvania, somewhere near Philadelphia, where the species undoubtedly occurs during migrations.

Crassus (**Vespertilio**). F. Cuvier, Nouv. Ann. Mus. d' Hist. Nat., Paris, I, p. 18, **1832**. I can not identify F. Cuvier's *Vespertilio crassus.* The

---

tirées de la teinte différente du pelage, m'ont paru établir avec assez de certitude la non-identité d'espèce de ce vespertilion avec le *murinus;* c'est ce qu'indiquent en outre les proportions du crâne. Le chanfrein est plus court et plus large dans le vespertilion de la Caroline. En voici les dimensions: longueur du corps, 61 millimètres; de la queue, 28; de l'envergure, 259.

"Cette espèce n'a point encore été décrite: elle m'a été remise par M. Bosc, qui se l'est procurée lors de son séjour à la Caroline. Ce savant naturaliste a bien voulu m'informer qu'elle y est excessivement commune. On la reconnoîtra aux caractères suivans: *Oreilles oblongues, de la longueur de la tête, velues en partie; oreillon en demi cœur. Pelage d'un brun marron en dessus, jaunâtre en dessous.*"

[1] In the Harvard College library, Cambridge, Mass., and in the Smithsonian library, Washington, D. C.

[2] 17. Chauve-souris grise. Deux premières dents supérieures fort petites & peu apparentes. Tête blanchâtre; oreilles rondes, plates, blanches, le pourtour noir, une appendice à la base. Poils du corps gris, vers la base; noirs vers la pointe & blancs à l'extrémité; de sorte que l'animal à l'air d'être moucheté de blanc. Ces poils s'étendent jusque sur la membrâne qui enveloppe la queue. La membrâne ailiforme est également velue en dessous à la partie antérieure, ainsi qu'au dessus à la base de l'ongle saillant. Cette membrâne est environ une fois plus grande que dans l'espèce précédente [*Vespertilio fuscus*]. Elle a de douze à quatorze pouces d'envergeure. Les narines sont émarginées.

Grey Bat. *Vespertilio linereus* [sic].

Elle ne se trouve point décrite dans les auteurs. Cette chauve-Souris se trouve dans la Pensilvanie.

animal may be *Nycticeius humeralis*, but there is nothing in the original description[1] to indicate this with certainty. Fortunately the name is not needed as all the species now known to inhabit the eastern United States were already named at the time when it was published.

Creeks (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 18, **1832**. *Vespertilio creeks* F. Cuvier is another unidentifiable species. Le Conte, however, who sent the type specimen to Cuvier, states that the animal is the same as *Nycticea crepuscularis* Le Conte (= *N. humeralis* Rafinesque). Nothing in the original description[2] contradicts this assertion.

Crepuscularis (Nycticea). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831**. This bat is the *Nycticeius humeralis* of Rafinesque.

Cubanus (Vesperus). Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 150, **1861**. The description of this species indicates a *Nycticeius* closely related to *N. humeralis.* As I have seen no Cuban specimens, I am unable to say whether the animal is specifically distinct from the mainland form (see p. 121).

Cubensis (Scotophilus). Gray, Ann. Nat. Hist., IV, p. 7, **1839**. *Scotophilus cubensis* Gray is evidently the Cuban *Vespertilio.* The original description is as follows:

> Fur blackish brown (in spirits); wings dark, blackish; underside of the interfemoral membrane whitish, with scattered hairs; feet large; heel bone short, tapering; ears moderate, entire; tragus ovate-lanceolate. Body and head 2¾; tail 1¾; fore arm 1¾. Hab. Cuba.

This is the first name based on the animal to which it refers.

Cyanopterus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818**. Rafinesque's *Vespertilio cyanopterus* can not be identified with any known bat. The original description is as follows:

> Tail one-third, 2 incisores above, 6 beneath, body dark gray above, bluish gray beneath. wings of a dark bluish gray, shafts black, ears auriculated, longer than the head. Length 3 inches, breadth 10.

---

[1] A la tête des Murinoïdes, deux fausses molaires anomales de chaque côté des deux mâchoires; l'oreille obtuse el l'oreillon en couteau.

Toutes les parties supérieures du corps sont d'un brun-marron grisâtre, et les parties inférieures blondes; les poils, à leur origine, sont plus foncés qu'à leur extrémité.

Des moustaches garnissent les côtés de la lèvre supérieure et l'extrémité de la mâchoire inférieure.

Longueur du corps, du bout du museau à l'origine de la queue, 2 pouces; de la queue, 1 pouce 8 lignes; envergure, 8 pouces 8 lignes.

Cette espèce est due à M. Lesueur, qui l'a envoyée de New-York, sous le nom que je lui ai conservé.

[2] 5° Le V. Creeks, *V. Creeks.*

A la tête du Sérotinoïdes, point de fausses molaires anomales à la mâchoire supérieure, et une seule à l'inférieure; l'orielle est échancrée, et l'oreillon en couteau; les parties supérieures sont d'un brun jaunâtre, les parties inférieures d'un gris sale, les poils de toutes ces parties sont noirs à leur base. Des moustaches garnissent les côtés du museau et le dessous de l'extrémité de la mâchoric inférieure.

Longuer du corps, du bout du museau à l'origine de la queue, 2 pouces; de la queue, 1 pouce 6 lignes; envergure, 9 pouces.

De Géorgie. Dû aux recherches de M. le major Leconte.

Cynocephalus (Nycticea). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 432, **1831.** This is a free-tailed bat, the common *Nyctinomus* of the southeastern United States.

Domesticus (Vespertilio). Green, Doughty's Cabinet of Natural History, II, p. 290, **1832.** The description refers without much doubt to *Myotis lucifugus* Le Conte, named only one year previously. Type locality a village in western Pennsylvania near a stream which enters the Ohio a few miles from Pittsburg.

Dutertreus (Vespertilio). Gervais, in Ramon de la Sagra's Hist. de l'Ile de Cuba, Mamm., p. 6; Atlas, Tome II, **1840.** This is *Vespertilio fuscus cubensis* (Gray), as shown by the number of teeth, 32, and by the size, forearm 47 mm.

Erythrodactylus (Vespertilio). Temminck, Monographies de Mamm., II, p. 238 (13me Monogr.), **1835–41.** Temminck describes his *Vespertilio erythrodactylus* as a bat with short, roundish ears, long tail, interfemoral membrane hairy on basal half above, four upper incisors, and general reddish-brown color.[1]

This is a combination of characters normally possessed by no known North American bat. The type is said to have come from the neighborhood of Philadelphia. It is probably *Pipistrellus subflavus* reddened by alcohol (see p. 8).

Evotis (Vespertilio). H. Allen, Monogr. North Am. Bats, p. 48, **1864.** This is the first name for the large-eared *Myotis* of the western United States.

Exilis (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283, **1866.** *Vespertilio exilis* is a synonym of *Myotis californicus.* The type came from Cape St. Lucas.

Frantzii (Atalapha). Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin (1870), p. 908, **1871.** Peters's *Atalapha frantzii* from Costa Rica is the small, scantily furred southern race of *Lasiurus borealis.* It had previously been described as *Atalapha mexicana* by Saussure.

---

[1] Taille moindre que la *pipistrelle.* Tout l'antibrachium, la base des doigts et la membrane interdigitale du premier doigt rougeâtre; les autres membranes noires. Oreilles poilues depuis la base jusqu'à plus de moitié de la longueur, petites ovoïdes; tragus en feuille de saule; queue très longue à grand bout libre; membrane interfémorale en dessus moitié poilue; par dessous, rayée de veines en losange, d'où naissent des soies très courtes disposées à claire-voie. Dents incisives 4 par paire en haut et 6 en bas; molaires 5 partout, seulement une fausse molaire à la mâchoire supérieure.

Pelage long, fin et soyeux; en dessus tricolore, au dessous bicolore. Toutes les parties supérieures d'une teinte brune-rougeâtre; mais un peu jaunâtre à la tête et au cou; les poils étant noirs à la base, puis jaunâtre et le bout brun-rougeâtre; moitié de l'interfémorale très poilue; en dessous brun foncé à la base et brun-roussâtre au bout; membranes des flancs et interfémorale couvertes de poils rares.

Longueur totale 2 pouces 10 lignes ou 3 pouces pour maximum, dont la queque prend 1 pouce 4 lignes; antibrachium 1 pouce 2 lignes; envergure 7 pouces 6 lignes ou 8 pouces au maximum. * * *

Patrie. L'Amérique septentrionale dans les environs de Philadelphie.

Funebris (Lasiurus). Fitzinger, Sitzungsber. K. Akad. Wiss., Wien, 1ste Abth., LXII, p. 46, 1870. *Lasiurus funebris* Fitzinger, based on the *Nycticejus noveboracensis* of Temminck,[1] from Tennessee and Missouri, is a synonym of *Lasiurus borealis* (Müller), as shown by the reference to the reddish-brown color and white shoulder spot.

Fuscata (Atalapha). Rafinesque, Annals of Nature, p. 2, 1820. Rafinesque's *Atalapha fuscata* can not be identified. The original description is as follows:

> Ears longers than the head, auriculated and blackish; tail three-sevenths of total length, jutting only by an obtuse point; body brownish above, grayish beneath shoulders and cheeks dark brown; hind feet blackish, hairy above; wings blackish brown.—Found in the northern parts of the state of New York and in Vermont. Total length three and an half inches. My genus *Atalapha* (Prec. dec.) contain all the Bats without fore teeth; there are 3 or 4 species of them in the United States all blended under the name of *Vespertilio* (or *Noctilio*) *noveboracensis* by the writers.

Fuscus (Vespertilio). Beauvois, Catalogue Raisonné du Museum de Mr. C. W. Peale. Philadelphie, p. 18, 1796. *Vespertilio fuscus* Beauvois is the first name based on the common brown bat of the eastern United States.[2] The original description is faulty, as it contains a glaring error with respect to the number of upper incisors, which are said to be only two. Nevertheless there can be no doubt as to the animal that Beauvois intended to describe, since only one brown bat of the size of *Myotis myotis* ('la chauve-souris ordinaire de France') inhabits the region about Philadelphia.

Georgianus (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 16, 1832. The specific name *georgianus* long passed current for the small *Pipistrellus* inhabiting the eastern United States. In 1893 H. Allen substituted for it the older name *carolinensis* Geoffroy. As already shown, however, there can be no doubt that Geoffroy's animal was *Vespertilio fuscus*. It is equally certain that Cuvier's name can not be applied to the Georgian bat, since his description probably refers to a *Myotis*, while in the same paper Cuvier accurately describes the Georgian bat as *Vespertilio subflavus*. Le Conte, who collected the specimens on which several of Cuvier's species were based, describes the Georgian bat under the name *georgianus*,[3] and expressly states that this was the animal that the French author had in hand. The evidence is so strongly against this view that Le Conte's statement may be safely disregarded.[1]

---

[1] Monographies de Mammalogie, II (13me Monogr.), p. 158.

[2] 16. Chauve-souris brune. Deux premières dents supérieures, distantes l'une de l'autre, & voisines des canines, une fois plus courtes que ces dernières: oreilles nues, noirâtres, ovales, avec un appendice à leur base; queue presqu'aussi longue que le corps (la tête excepté) membrâne ailiforme noirâtre: poils du corps bruns en dessus, grisâtres en dessous.

Brown bat. *Vespertilio fuscus.*

Cette Chauve-souris est la plus commune que l'on trouve dans les envirovs de Philadelphie. Elle ressemble beaucoup à la chauve-souris ordinaire de France, mais en diffère essentiellement par le nombre des dents de la machoire supérieure.

[3] Proc. Acad. Nat. Sci. Phila., VII (1854–55), p. 434, 1856.

Greenii (Scotophilus). Gray, List Spec. Mamm. Brit. Mus., p. 30, **1843.** Gray's *Scotophilus greenii* is a *nomen nudum* which refers without much doubt, however, to *Vespertilio fuscus.* The name is introduced as follows: "GREEN'S BAT. SCOTOPHILUS Greenii. *a* In spirits.—North America. Presented by Jacob Green, M.D."

Gryphus (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., I, p. 15, **1832.** Dr. Harrison Allen has recently used the name '*Vespertilio*' *gryphus* for the '*V.*' *lucifugus* and '*V.*' *subulatus* of his first monograph which he unites as subspecies.[2] The combination of characters; two premolars in each jaw, light yellow color, and hairy lips,[3] is not known in any bat inhabiting the eastern United States. Hence the description is wholly undeterminable. Le Conte refers the name to *Vespertilio fuscus*,[4] but this determination is very doubtful.

Henshawii (Vespertilio nitidus). H. Allen, Monogr. Bats N. Am., p. 103, **1893.** *Vespertilio nitidus henshawii* H. Allen is a synonym of *Myotis californicus*, based on pale examples of the latter from near Wingate, N. Mex.

Hesperus (Scotophilus). H. Allen, Monogr. N. Am. Bats, p. 43, **1864.** This is the first name based on the common *Pipistrellus* of the southwestern United States.

Humeralis (Vespertilio). Rafinesque, American Monthly Mag., III, p 445, **1818.** While there is nothing absolutely diagnostic in the original description[1] of this species, its subsequent treatment is such as to leave no reasonable doubt that Rafinesque had in mind the bat afterward named *Nycticea crepuscularis* by Le Conte. In 1819 Rafinesque based the genus *Nycticeius* on two of his species of *Vespertilio* which differed from all others known to him in the possession of only two incisors in the upper jaw. One of these, *V. tesselatus*, was the red bat, *Lasiurus borealis*. The other, *V. humeralis*, must have been the twilight bat, as there is nothing in the description that precludes it, and no other small species with two upper incisors is known in the eastern United States.

---

[1] The original description of *Vespertilio georgianus* is as follows:

"A la tête des Murinoïdes; l'oreille est échancrée et l'oreillon en alêne. Toutes les parties supérieures du corps sont colorées par un mélange de noir et de blond jaunâtre. Le noir paroît, parceque la pointe des poils qui est blonde ne recouvre pas, à cause de sa brévité, le reste de la longueur de ces poils qui est noir. Les parties inférieures sont grises, mais mélangées de noir, par la même cause qui fait paroître cette couleur aux parties supérieures. Des moustaches garnissent les côtés des lèvres supérieures, et le dessous de l'extrémité de la mâchoire inférieure.

"Longueur du corps, du bout du museau à l'origine de la queue, 1 pouce 6 lignes; de la queue, 1 pouce 2 lignes; envergure, 7 pouces.

"De Géorgie. Dû aux recherches de M. le major Leconte."

[2] Monogr. Bats N. Am., p. 75, 1893.

[3] The description is as follows:

"A la tête des Murinoïdes et deux fausses molaires anomales fort petites de chaque côté des deux mâchoires; l'oreille est échancrée et l'oreillon en couteau. Toutes les parties supérieures du corps sont d'un blond jaunâtre, les parties inférieures sont grises, mais les poils des uns et des autres sont noirs à leur extrémité inférieure. Les parties nues sont violâtres. Des moustaches garnissent les côtés de la lèvre supérieure et le dessous de l'extrémité de la mâchoire inférieure. Longueur du corps, de l'extrémité du museau à l'origine de la queue, 1 pouce 9 lignes; de la queue, 1 pouce 2 lignes; envergure, 7 pouces 10 lignes.

"Des environs de New York. Dû aux recherches de M. Milbert."

[4] Proc. Acad. Nat. Sci. Phila. VII (1854–55), p. 434, 1856.

Incautus (Vespertilio). J. A. Allen, Bull. Am. Mus. Nat. Hist., VIII, p. 239, November 21, **1896**. *Vespertilio incautus* J. A. Allen, is a synonym of *Myotis velifer* (J. A. Allen), based on specimens of the latter from San Antonio, Tex. (See p. 59.)

Intermedius (Lasiurus). H. Allen, Proc. Acad. Nat. Sci. Phila. (1862), p. 146, **1863**. This is the only specific name based on the bat now known as *Dasypterus intermedius*.

Keenii (Vespertilio subulatus). Merriam, American Naturalist, XXIX, p. 860, September 1, **1894**. *Vespertilio subulatus keenii* is the only name based on the dark form of *Myotis subulatus* occurring on the Queen Charlotte Islands, British Columbia.

Lanceolatus (Vespertilio). Maximilian, Reise in das Innere Nord-America, I, p. 364, footnote, **1839**. The specific name *lanceolatus* was proposed by Maximilian as a substitute for *subulatus*, should the animal which he designated by the latter name prove to be different from Say's.[2] Maximilian's *subulatus* is described at considerable length and is probably the *Vespertilio lucifugus* of Le Conte. The following measurements are given: Total length, 3″ 1‴; extent, 8″ 9‴; tail, 1″ 3‴; ear, 6‴; tragus, 2½‴.

Lasiurus (Vespertilio). Schreber, Säugthiere, Abth. I, Pl. LXII B, published with Abth. IV, Heft 34, **1781**.[3] The figure of *Vespertilio lasiurus* is a good representation of the red bat (*Lasiurus borealis* Müller, 1776). Dobson[4] cites this name as dating from 1775, in which case it would be the earliest for the species. This is, however, a mistake. Pl. LXII appeared with Abth. I in 1774, but Pl. LXII B, was not published until 1781 with Abth. IV, Heft 34. The species is mentioned in Abth. I (p. 176) as 'Die nordamerikanische Fledermaus.'

Lasurus (Vespertilio). Boddaert, Elenchus Animalium I, p. 71, **1785**.

---

[1] Tail three-sevenths, upper incisores 2, remote, lower 6, body dark brown above, shoulders black, gray beneath, wings, tail, ears, and snout blackish, eyes under the hair, ears longer than the head, elliptical, auriculated. Length 3 1–2 inches, breadth 11.

[2] Diese Fledermaus beschrieb ich in meinem Tagebuche unter der Benennung *Vesp. lanceolatus*, sie hat aber viel Aehnlichkeit mit Say's *V. subulatus*. Zu Bethlehem in Pennsylvanien erhielt ich zwei Exemplare * * * .

[3] For date of publication see Sherborn, Proc. Zool. Soc. London, 1891, p. 589.

[4] Catal. Chiroptera Brit. Mus., p. 269, 1878.

Vespertilio lasurus Boddaert is probably a misprint for *V. lasiurus*, since reference is made to Schreber's plate.[1]

Lecontii (Plecotus). Cooper, Ann. Lyceum Nat. Hist. New York, IV, p. 72, **1848.** Concerning *Plecotus lecontii*, Cooper says:

> The name *macrotis* I have ventured to supersede, as being in nowise distinctive of the species, but in reality derived from a generic character, which in some species is more developed than in the present. The ears being therefore rather *small* for the genus, this name becomes contradictory; and no American naturalist will regret the opportunity thus afforded of paying a well merited tribute to the discoverer of so many rare and remarkable animals of this country.

The name is of course a synonym of *macrotis* Le Conte.

Leibii (Vespertilio). Aud. & Bach., Journ. Acad. Nat. Sci. Phila., VIII, Pt. II, p. 284, **1842.** *Vespertilio leibii* Aud. & Bach., from Erie County, Mich. [now Ohio] is probably *Myotis lucifugus* Le Conte. The measurements are as follows: "Length of head and body 1 inch 7 lines; tail 1 inch 4 lines; spread 7 inches; height of ear posteriorly 2½ lines; tragus 1 line."

Longicrus (Vespertilio). True, Science, VIII, No. 203, p. 588, Dec. 24, **1886.** *Vespertilio longicrus* True, is the only name based on the common western subspecies of *Myotis subulatus*.

Lucifugus (Vespertilio). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831.** The original description of *Vespertilio lucifugus* Le Conte is as follows:

> Anterior upper fore-teeth bilobate; body above dark brown, beneath cinereous; nose sub-bilobate; face with a nakedish prominence on each side; ears oblong, naked, tragus sub-linear, half as long as the ears; tail projecting a little beyond the membrane; length to the insertion of the tail two inches and a quarter; tail one inch and a quarter.

From this alone it would be impossible to identify the animal that the writer had in mind. Fortunately, Le Conte treated the species in more detail in a paper published in the Proceedings of the Academy of Natural Sciences of Philadelphia for 1855 (pp. 431–438). Here he recognizes three species of '*Vespertilio*' with thirty-eight teeth as occurirng in the eastern United States. These are *V. subulatus*, *V. lucifugus*, and *V. georgianus*. *V. georgianus* is clearly *Pipistrellus subflavus*, which Le Conte placed with the thirty-eight-toothed species through an error in counting the teeth. *V. lucifugus* and *V. subulatus* of Le Conte are evidently based on individual variations in the shorter-eared of the two eastern species of *Myotis*. The only differences in Le Conte's descriptions of the two forms are the following: *V. subulatus:* Ear slightly emarginate; length 2.9; tail 1.1; extent 9.4; head .9; ears .4; orillon .3. *V. lucifugus:* Ears so much emarginated as to appear hooked; length 3.8; tail 1.6; extent 11.7; head .75; ears .45; orillon .2.

---

[1] Boddaert's account is as follows:

"Lasurus. 16. V. cauda longissima, rostro obliquo truncato, *la longue Queue.* Schreb., tab. 52. B *longtailed Bat.*"

Habitat: "Quare Doct. Erxleben, Zimmermann, Pennant hunc notabilem vespertilionem omiserunt, mihi latet."

Macleayii (Scotophilus). Gray, List Spec. Mamm. Brit. Mus., p. 30, **1843.** *Scotophilus macleayii* Gray is a nomen nudum, probably based on *Vespertilio fuscus cubensis.* Gray says merely: "MACLEAY'S BAT. SCOTOPHILUS MacLeayii *a* In spirits. Male. Cuba.—Presented by W. S. MacLeay, Esq."

Macropus (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 288. **1866.** *Vespertilio macropus* H. Allen is a synonym of *Myotis yumanensis* (H. Allen). The name is, moreover, preoccupied by *Vespertilio macropus* Gould, 1854.[1]

Macrotis (Plecotus). Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831.** *Plecotus macrotis* Le Conte is the first name certainly applied to the bat now known as *Corynorhinus macrotis.* Rafinesque's *Vespertilio megalotis* may have been the same animal, but his description is so poor that it is impossible to determine what he refers to.

Maculatus (Histiotus). J. A. Allen, Bull. Am. Mus. Nat. Hist., New York, III, p. 195, **1891.** *Histiotus maculatus* is the name under which the bat now known as *Euderma maculatum* was first described.

Megalotis (Vespertilio). Rafinesque, American Monthly Mag., III, p. 446, **1818.** There is nothing in the original description[2] of Rafinesque's *Vespertilio megalotis* by which the species can be identified. It is possibly the animal afterwards named *Plecotus macrotis* by Le Conte.

Melanops (Eptesicus). Rafinesque, Annals of Nature, p. 3, **1820.** When Rafinesque transferred his *Vespertilio phaiops* to the genus *Eptesicus*, he changed the specific name to *melanops*, thus adding another to the synonyms of *Vespertilio fuscus.*

Melanorhinus (Vespertilio). Merriam, North American Fauna, No. 3, p. 46, September 11, **1890.** *Vespertilio melanorhinus* Merriam is a synonym of *Myotis californicus*, based on a specimen of the latter from San Francisco Mountain, Arizona.

Melanotus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** Rafinesque's *Vespertilio melanotus* is hopelessly indeterminable. The original description is:

> Tail one-third, brown above, gray beneath, body blackish above, whitish beneath, wings dark gray, shafts black, ears auriculated, rounded. Length 4 1–2 inches, breadth 12 1–2.

Melas (Eptesicus). Le Conte, Proc. Acad. Nat. Sci. Phila., VII (1854–55), p. 438, **1856.** In a paper on the bats of the United States published in 1856, Le Conte refers to *Eptesicus melas* Rafinesque as an unidentified species. I have been able to find no such name in any of Rafinesque's writings and therefore suppose that *Eptesicus melas* is a misprint for *E. mydas*, especially as the latter is not mentioned by Le Conte.

---

[1] Mammals of Australia, III (*fide* Dobson).

[2] Tail three-eighths of total length, body dark gray above, pale gray beneath, ears very large, duplicated, auricules nearly as long. Length 4 inches, breadth 12 inches.

Merriami (Vesperugo). Dobson, Ann. & Mag. Nat. Hist., XVIII, p. 124, 1886. *Vesperugo merriami* Dobson, was based on a specimen of *Pipistrellus hesperus* from Red Bluff, Tehama County, Cal., wrongly supposed to have been taken at Locust Grove, N. Y.

Mexicana (Atalapha). Saussure, Revue et Mag. de Zool., 2e sér., XIII, p. 97, 1861. *Atalapha mexicana* Saussure is the first name based on the southern race of *Lasiurus borealis*, afterwards described by Peters as *Atalapha frantzii.*

Mexicanus (Vespertilio). Saussure, Revue et Mag. de Zool., 2e sér., XII, p. 282, July, 1860. Under the name *Vespertilio mexicanus* Saussure described the large, dark Mexican form of *Myotis californicus*, which had hitherto received no name.

Miradorensis (Scotophilus). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 287, 1866. *Scotophilus miradorensis* H. Allen is the only name based on the large southern form of *Vespertilio fuscus.*

Monachus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, 1818. The original description of Rafinesque's *Vespertilio monachus* leaves no doubt that it refers to *Lasiurus borealis* (Müller). It is as follows:

> Tail one-fourth, hairy above, fringed laterally, body pale, fallow above and below, head and neck covered with a longer fur of a dark red fallow, wings dark gray, shafts red, hind feet black, nose red, ears concealed in the fur. Length 4 inches, breadth 12.

Monticola (Vespertilio). Aud. & Bach., Journ. Acad. Nat. Sci. Phila., I, No. 7, p. 92, October, 1841. *Vespertilio monticola* is probably *Pipistrellus subflavus* (F. Cuvier), though the description is not wholly pertinent to this species. The original account is as follows:

> *Vespertilio monticola* (Mountain bat).—V. vespertilione subulata brevior; auriculus brevioribus; tragus nonexcedentibus, dimidiam longitudinem auriculæ; colore fulvo.
>
> *Mountain Bat.*—Smaller than Say's bat (*V. subulatus*); ears shorter; tragus, less than half the length of the ear; color, yellowish brown. Upper fore teeth bilobate, ears moderate, naked, erect, rather broad at base; tragus linear, subulate, body small; wings long; tail projecting a line beyond the interfemoral membrane, which is slightly sprinkled with hair above and beneath.
>
> *Color.*—The nose and chin are black; ears light brown; wing membranes dark brown. The whole of the fur of the body, above and beneath, is from the roots, of a uniform yellowish-brown color.
>
> The species differs from Say's bat not only in color, but in the much shorter ears and tragus. The size and shape of the tragus we have found an invaluable guide in our American bats; the ears of the present species, when alive, are always erect; while those of Say's Bat are folded backward like those of the long-eared Bats—*Plecotus.* * * *
>
> *Dimensions.*—Length of head and body, 1 inch 8 lines; length of tail, 1 inch 6 lines; length of spread, 8 inches; height of ear posteriorly, 3 lines; height of tragus, 1¼ lines.
>
> N. B.—The tragus in Say's Bat is four-and-a-half lines in height. Several specimens of this Bat were obtained during the summer, on the mountains of Virginia, at the Grey Sulphur Springs. They were uniform in size and color.

Mydas (Eptesicus). Rafinesque, Annals of Nature, p. 3, **1820.** The description of *Eptesicus mydas* leaves the species hopelessly indeterminable. It is as follows:

> Fulvous above, grey beneath; wings, ears and tail, pale brown, shafts whitish; ears double the length of the head; tail naked, slightly mucronate, nearly as long as the body.—I have observed it in the barrens of Kentucky flying in the houses. Total length three inches, of which the tail includes five-twelfths. Ears three-quarters of an inch long. I mentioned it under the name of *Vesp. mydas* in my account of the Bats of the western states, (Am. Mag. v. 3). I have since instituted two other genera with them, *Hypexodon* and *Nycticeius* (Prodr. 70 N. G. An); the others are probably Atalaphes. I know already fifteen species of Bats in the United States, almost all new ones.

No bat is known to occur in Kentucky that combines the characters attributed to this animal.

Mystax (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** This species which Rafinesque had already referred to as *Noctilio mystax*,[1] is described as follows:

> Tail two-fifths of total length, upper incisores none, lower 6, 2 warts at the lower jaw, body entirely fallow, top of the head brownish, ears brown, auriculated, longer than the head. Length 5 inches, breadth 14.

In the diagnosis of the genus *Hypexodon*, based on this species, some further characters—such as 'nostrils round, projecting,' and 'lips whiskered'—are added, which only serve to increase the impossibility of identifying the animal.

Nigricans (Vespertilio). Maximilian, Beiträge Naturgesch. Brasil., II, p. 266, **1826.** *Myotis nigricans* (Maximilian) is a species closely related to *M. californicus*, which it replaces in the tropical fauna from southern Mexico southward. The name was applied to *M. californicus* by Dr. Harrison Allen in his recent monograph (1893). In the original description Maximilian cites Schinz ('Thierreich u. s. w. B. I. p. 179') as authority for the name. As I have been unable to verify this reference I do not know whether the name was actually published before **1826.**

Nitidus (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila. (1862), p. 247, **1863.** *Vespertilio nitidus* H. Allen, is the common small brown bat of the western United States and therefore the name is a synonym of *V. californicus* Aud. & Bach., 1842.

Noctivagans (Vespertilio.) Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 431, **1831.** This is the first name based on the silver-haired bat, *Lasionycteris noctivagans*.

Noveboracensis (Vespertilio). Erxleben, Syst. Regni Anim., I, p. 155, **1777.** Erxleben's *Vespertilio noveboracensis* was based on the New York bat of Pennant (Synop. Quadr., p. 367), 'Die nordamerikanische Fledermaus' of Schreber (Säugthiere, I, p. 176), and 'Der Neujorker' of Müller (Natursyst. Suppl., p. 20). It is therefore the red bat, *Lasiurus borealis*.

Noveboracus (Vespertilio). Boddaert, Elenchus Animalium, I, p. 71, **1785.** This is the red bat, *Lasiurus borealis* Müller. Boddaert mentions the white shoulder marks characteristic of the species and refers to Schreber and Pennant.

---

[1] American Monthly Mag., III, p. 354.

Obscurus (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 281, **1866.** *Vespertilio obscurus* H. Allen, is one of the numerous synonyms of *Myotis californicus.* The type specimens came from Lower California.

Oregonensis (Vespertilio). H. Allen, Mongr. Bats N. Am., p. 61, **1864.** The wording of Dr. Allen's account of *Vespertilio oregonensis* is so ambiguous as to leave some doubt as to whether he intended to apply the name to specimens from Fort Yuma and Cape St. Lucas (Nos. 5405, 5537, and 5402) or to a skin labeled *oregonensis* by Le Conte. In either case the name is a synonym of *V. californicus* Aud. & Bach. Under *V. nitidus* he says:

> Nos. 5405, 5537, and 5402, four specimens in all, present the following peculiarities: The fur is longer than in others of the collection. On the back the base of the hair is blackish; upper third pale yellow, turning to a delicate light-yellowish russet brown; on the belly the hair is dark brown at the base, with light tips; the hairs on the interfemoral membrane are also of a light color. In other respects the characters are the same as the other specimens. The dried specimen, No. 5512, labeled by Dr. Le Conte *V. oregonensis*, though never described by him, probably belongs to this variety. If the individuals having the above coloration should be found to constitute a new species, this name will be reserved for it.

Pallidus (Vespertilio). Le Conte, Proc. Acad. Nat. Sci. Phila., VII, (1854–55) p. 437, **1856.** *Vespertilio pallidus* Le Conte is the only name based on the Eastern form of *Antrozous*, the type of the genus. Le Conte stated that his species came from California, but this is evidently an error, as pointed out by Baird and Harrison Allen. The type, now in the United States National Museum, is labeled 'Fort Clark, Texas.' It agrees in all respects with skins taken in the same region by Dr. E. A. Mearns.

Parvula (Rhogeëssa). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 285, **1866.** *Rhogeëssa parvula* H. Allen, from the Tres Marias Islands, Mexico, is probably distinct from any of the members of the genus that occur on the mainland. The type is now mislaid or lost.

Pfeifferi (Atalapha). Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 152, **1861.** Gundlach's *Atalapha pfeifferi* is the only name based on the Cuban form of *Lasiurus borealis.*

Phaiops (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** Under the name *Vespertilio phaiops*, Rafinesque gave an accurate description of *Vespertilio fuscus* Beauvois. He says:

> Tail one-third of total length, naked, mucronate, body dusky bay above, pale beneath, face, ears and wings blackish, 4 incisores in the upper jaw, 2 on each side, divided by a large flat wart, unequal, the outside ones larger and bilobed, 6 small incisores at the lower jaw. Length 41-2 inches, breadth 13.

Priscus (Nyctitherium). Marsh, American Journ. Sci. & Arts, 3d ser., IV, p. 128, **1872.** *Nyctitherium priscus* Marsh is a name based on a fragment of a fossil lower jaw from the Eocene or lower Miocene near Henrys Fork, Wyoming.

Propinquus (Vesperus). Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 262, **1872**. *Vesperus propinquus* Peters from Santa Ysabel, Guatemala, is the small southern form of *Vespertilio fuscus*. I can find no other name based on this animal.

Pruinosus (Vespertilio). Say, Long's Expedition to the Rocky Mountains, I., p. 167, footnote, **1823**. *Vespertilio pruinosus* Say, is the hoary bat, *Lasiurus cinereus* (Beauv.). It was described from a specimen taken at Engineer Cantonment, Washington County, Nebraska, 3 miles above the mouth of the Boyer River and not far from Council Bluffs, Iowa.

Pulverulentus (Vespertilio). Temminck, Monogr. de Mamm., II, p. 235, (13e Monogr.), **1835–1841**. Under the name *Vespertilio pulverulentus* Temminck gives an accurate description of a specimen of *Lasionycteris noctivagans* taken on the Missouri River.

Rafinesquii (Plecotus). Lesson, Manuel de Mammalogie, p. 96, **1827**. *Plecotus rafinesquii* Lesson is a name based on Rafinesque's indeterminable *Vespertilio megalotis*.[1]

Rubellus (Vespertilio). Beauvois, Catalogue Raisonné du Museum de Mr. C. W. Peale. Philadelphie, p. 18, **1796**. *Vespertilio rubellus* Beauvois is the red bat, *Lasiurus borealis* (Müller).[2]

Rubra (Vespertilio). Ord, in Guthrie's Geography, 2d American ed., II, p. 291, **1815** (Rhoads' Reprint, 1894). This is another synonym of *Lasiurus borealis* (Müller). The name appears in a nominal list of North American bats. In a footnote, however, Ord says: "Described by Mr. Wilson. See American Ornithology, Vol. VI, p. 60." Wilson's description, as well as his figure on plate 50 (fig. 4) of the 1812 edition, refers unquestionably to the red bat.

Rufus (Vespertilio). Warden, Description des Etats-Unis de l'Amérique Septentrionale, V, p. 606, **1820**. Warden's *Vespertilio rufus* is another synonym of *Lasiurus borealis* based on Wilson's description and figure.

Salarii (Vespertilio). F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 15, **1832**. Like most of the species described in the same paper,

---

[1] The original description is as follows:

"Pelage d'un gris foncé en dessus, et d'un gris pâle en dessous; oreilles très grandes et doubles, pourvues d'oreillons aussi longs qu'elles; n'est peut-être qu'une variété de notre oreillard. Habite les Etats-Unis."

[2] 18. Chauve-Souris rougeatre. Deux premières dents plus petites que les canines, mais apparentes, tête ainsi que le corps d'une couleur rougeâtre mêlée de quelques poils blanchâtres. Oreilles couleur de chair, nues, repliées et appendiculiées à leur base. Narines émarginées et distantes l'une de l'autre. Vespertilio rubellus. Redish bat.

Les poils du corps forment quelques fois des zones rougeatres et blanches. La membrâne ailiforme est velue en dessus à la partie antérieure, et couverte de poils roux dessus et autour de la queue. L'individu que nous décrivons est d'autant plus curieux qu'il a été pris avec trois petits qu'il porte sur son ventre. Ce qu'il y a de plus particulier, c'est que d'eux d'entr'eux ressemblent parfaitement à la mère pour la couleur et l'autre est tout à fait roux. La membrane ailiforme est couvertes de raie un peu transparentes qui vues au jour, représentent des quarrés en forme de Lozange. La couleur noire de cette membrane contraste avec les couleurs du corps et celle des divisions des pattes de devant, qui sont de couleur de chair, lorsque l'animal est en vie.

Vespertilio salarii is indeterminable. No known North American bat combines hairy lips, reddish brown color, and two premolars in each jaw.[1]

Seminola (Atalapha borealis). Rhoads, Proc. Acad. Nat. Sci. Phila., p. 32, 1895. This is the dull mahogany-brown race of *Lasiurus borealis* peculiar to the Austroriparian fauna. No other name has been based on this animal.

Septentrionalis (Vespertilio gryphus). Trouessart, Catalogus Mammalium tam Viventium quam Fossilium, p. 131, 1897. Trouessart's *Vespertilio gryphus* var. *septentrionalis* is the only name unquestionably based on the *Myotis* commonly known as *Vespertilio subulatus* Say. It is merely a latinization of 'northern form of *Vespertilio gryphus*,' the designation applied by Dr. Harrison Allen in his Monograph of 1893 to the *V. subulatus* of his first monograph.

Serotinus (Nyctilestes). Marsh, Am. Journ. Sci. & Arts, 3d ser., IV, p. 215, 1872. The name *Nyctilestes serotinus* was applied by Marsh to the fossil jaw of a bat found by him at Grizzly Buttes, Wyoming.

Subflavus (Vespertilio). Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, I, p. 17, 1832. *Vespertilio subflavus* is one of the few North American bats named by F. Cuvier that can be identified. It is without doubt the Georgia bat (*Pipistrellus subflavus*), commonly known as '*Vesperugo georgianus*.' The peculiar coloring of this species, unique among the bats of the eastern United States, is very accurately described.[2] This is the first account of an American bat in which this color pattern is referred to. The mixture of dark and light hues in Cuvier's *V. georgianus* is due to the shortness of the fur in his specimen, which allows the dark bases of the hairs to appear irregularly on the surface. This is not at all the case with the small *Pipistrellus* of the eastern United States. In this bat the hairs are tricolored, dark at the bases, yellowish in the middle, and dark at the extreme tips. This is exactly what Cuvier describes as the character of the fur of his 'Blondin' (*P. subflavus*).

---

[1] The original description is as follows:

"A la tête des Murinoïdes et deux fausses molaires de chaque côté des deux mâchoires; l'oreille est échancrée et l'oreillon en couteau. Toutes les parties supérieures du corps sont d'un brun-marron grisâtre, et les parties inférieures gris-blanchâtres. Aux parties brunes les poils sont plus foncés à leur moitié inférieure qu'à leur supérieure; ils sont noirs dans cette inférieure aux parties gris. Les parties nues sont brunes, des moustaches garnissent les côtés de la lèvre supérieure et le dessous de l'extrémité de la mâchoire inférieure.

"Longueur du corps, du bout du museau à l'origine de la queue, 1 pouce 6 lignes; de la queue, 1 pouce 7 lignes; envergure, 7 pouces 7 lignes.

"Des environs de New York. Dû aux recherches de M. Milbert."

[2] The original description is as follows:

"A la tête des Murinoïdes; l'oreille est échancrée, et l'oreillon en demi-cœur. Les parties supérieures du corps sont d'un blond gris clair, légèrement ondulées de brunâtre; les parties inférieures d'un blanc jaunâtre; les poils des parties supérieures sont noirs à leur base, blanchâtres dans la plus grande partie de leur longueur, et brunâtres à leur pointe; ceux des parties inférieures sont noirs à leur moitié inférieure, et d'un blanc jaunâtre à leur autre moitié. Des moustaches garnissent les côtés de la lèvre supérieure, et le dessous de l'extrémité de la mâchoire inférieure.

"Longueur du corps, du bout du museau à l'origine de la queue, 1 pouce 6 lignes; de la queue, 1 pouce 3 lignes; envergure, 7 pouces.

"De Géorgie. Dû aux recherches de M. le major Leconte."

Subulatus (Vespertilio). Say, in Long's Exped. to Rocky Mts., II, p. 65 footnote, **1823.** The original description of *Vespertilio subulatus* leaves the species undeterminable. It is as follows:

> Ears longer than broad, nearly as long as the head, hairy on the basal half, a little ventricose on the anterior edge, and extending near to the eye; tragus elongated, subulate; the hair above blackish at base, tip dull cinereous; the interfermoral membrane hairy at base, the hairs unicoloured, and a few also scattered over its surface, and along its edge, as well as that of the brachial membrane; hair beneath black, the tip yellowish-white; hind feet rather long, a few setæ extending over the nails; only a minute portion of the tail protrudes beyond the membrane. Total length, $2\frac{9}{10}$ inches. Tail, $1\frac{1}{5}$ inches.

While there is nothing in this account that refers unquestionably to the longer eared of the two species of *Myotis* inhabiting the eastern United States, the name has passed current for this animal so long that, after careful consideration of all the evidence, I am unwilling to substitute for it Trouessart's name *septentrionalis*, the only one unequivocally based on the species. Say's *Vespertilio subulatus* came from the Arkansas River, near the present town of La Junta, Colorado. The bats of this region are not well known, but at present *Myotis evotis*, *M. californicus ciliolabrum*, and *M. lucifugus longicrus* are the only members of the genus *Myotis* which may confidently be expected to occur there. From the known range of *Myotis subulatus* to the north and west, however, its regular occurrence in Colorado is by no means impossible. Apparently Le Conte was the first subsequent writer to define the name *subulatus*, and, as has already been shown, his animal was an individual variation of the shorter eared of the two eastern species. If this determination be taken as final, there can be no question as to the necessity of adopting the name *septentrionalis* for the longer eared animal, but at present the power of the 'first reviser' is so much in question that too much should not be staked on it. Harrison Allen, in 1864, applied the name *subulatus* to the longer eared of the two forms, and in this sense it passed unchallenged until 1893, when the same author united the *lucifugus* and *subulatus* of his earlier monograph under the specific name *gryphus*. This change has not been generally adopted, so that in retaining the specific name *subulatus* I am merely continuing the usage of the past thirty-four years, not, however, without grave misgivings that the reasons for so doing are in reality unsound.

Teliotis (Atalapha). H. Allen, Proc. Amer. Philos. Soc., XXIX, p. 1, February 11, **1891.** *Atalapha teliotis* H. Allen is the only name based on the Californian form of *Lasiurus borealis*.

Tenuidorsalis (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283, **1866.** This is a synonym of *Myotis californicus* based on a specimen (No. 5533, U. S. Nat. Mus.) from Cape St. Lucas, Lower California.

Tesselatus (Vespertilio). Rafinesque, American Monthly Mag., III, p. 445, **1818.** Rafinesque's *Vespertilio tesselatus* is *Lasiurus borealis* (Müller). The original description is as follows:

> Tail half of total length, hairy above, upper incisores 2, remote, lower 6, body fallow above, head pale, dirty fulvous beneath, with a faint fallow collar, with 2

hairy white spots above near the thumb, membrane blackish, netted of fulvous internally and clotted of same externally, shafts fulvous, nose bilobate, ears nearly concealed by the hair. Length 4 inches, breadth 12.

Townsendi (Plecotus). Cooper, Ann. Lyceum Nat. Hist. New York, IV, p. 73, **1837.** *Plecotus townsendi* Cooper is the only name based on the form of *Corynorhinus* inhabiting the northwestern United States.

Tumida (Rhogeëssa). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 286, **1866.** *Rhogeëssa tumida* H. Allen is the only name based on the small Mexican bat to which it is now applied.

Ursinus (Vespertilio). Temminck, Monographies de Mammalogie, II (13^{e} Monogr.), p. 235, **1835-41.** The description of Temminck's *Vespertilio ursinus* refers without much question to *Vespertilio fuscus* Beauv., though the statement is made that there is no false molar in the upper jaw. Color, size, and external characters, however, agree with *V. fuscus.*

Velifer (Vespertilio). J. A. Allen, Bull. Am. Mus. Nat. Hist., New York, III, p. 177, **1890.** The name *Vespertilio velifer* has been applied by Dr. J. A. Allen to a large species of *Myotis* occurring in Mexico and the southwestern United States. The animal is closely related to the *Vespertilio albescens* of Dobson and may eventually prove to be the same as *V. albescens* Geoffroy.

Velox (Nyctitherium). Marsh, Am. Journ. Sci. & Arts, 3d ser., IV, p. 127, **1872.** *Nyctitherium velox* is a fossil bat from the Eocene or lower Miocene near Henry Fork, Wyoming.

Veræcrucis (Vesperugo). Ward, American Naturalist, XXV, p. 745, August, **1891.** *Vesperugo veræcrucis* Ward is the only name based on a form of *Pipistrellus* occurring in southern Mexico.

Virginianus (Vespertilio). Aud. & Bach., Journ. Acad. Nat. Sci. Phila., I, No. 7, p. 93, October, **1841.** *Vespertilio virginianus* can not be identified with any degree of certainty, though it is without much doubt one of the small species of *Myotis.* The original description is as follows:

> *Vespertilio virginianus* (Virginian bat).—V. vespertilione monticolâ paululum longior, auriculus paululum longioribus magisque acutis; dentibus primoribus maxillæ superioris simplicibus; interfemorali membranâ nudâ; corpore supra fuligineo-fusco; subtus cinereo-fuscato.
>
> *Virginian bat.*—A little larger than the Mountain Bat; ears a little longer and more pointed; upper fore teeth simple; interfemoral membrane naked; sooty brown above, ash brown beneath.
>
> *Dentition.*—Incisors $\frac{2-2}{6}$. Canines $\frac{1-1}{1-1}$.
>
> In size this species is intermediate between *V. carolinensis* and *V. subulatus.* The ear is naked, less rounded, and more pointed than either of the other closely allied species. The tragus is very narrow, linear, and less than half the length of the ear. The tail is inclosed in the interfemoral membrane, except the penultimate joint, which is free. The anterior upper fore teeth, instead of being sub simple, as in the *V. carolinensis,* or bilobate, as in *V. subulatus* and *V. montanus,* are simple.
>
> *Color.*—The nose, upper lip and upper jaw are black; wings dark brown. The back is sooty brown; on each shoulder, at the insertion of the wing, there is a circular black spot about 4 lines in diameter; on the under surface cinerious brown.

Dimensions.—Length of head and body, 2 inches 5 lines; length of tail, 1 inch; length of spread, 8 inches 8 lines; height of ear posteriorly, 4 lines; height of tragus, 1¾ lines.

Hab.—Mountains of Virginia.

Volans (Vespertilio). H. Allen, Proc. Acad. Nat. Sci. Phila., p. 232, **1866.** *Vespertilio volans* H. Allen is another of the numerous synonyms of *Myotis californicus.* The name was based on a specimen from Cape St. Lucas, Lower California.

Yumanensis (Vespertilio). H. Allen, Monogr. N. Am. Bats, p. 58, **1864.** *Myotis yumanensis* of H. Allen is the small, large-footed bat, to which the same author a few years later applied the name *macropus*, and finally in his second Monograph regarded as identical with *Myotis albescens* (Geoffroy).

In a paper published in the Proceedings of the Philadelphia Academy of Natural Sciences for 1866, Dr. Allen gives a revised description of *M. yumanensis*, based on a Fort Yuma specimen not mentioned in the original account of the species. This specimen was *M. californicus*, as shown by the very small hind foot which measured only two lines, or 4.2 mm., about half as much as the foot of *M. yumanensis.*

LISTS OF NORTH AMERICAN VESPERTILIONIDÆ.

Forty-six species and subspecies of *Vespertilionidæ* are here recognized as occurring in America north of Panama and in the West Indies. This number will probably be materially increased when the West Indian and Central American species are better known, and when adequate series of skins from the mainland permit the definition of certain geographic races which doubtless exist but whose characters can not be determined from the material now in collections. The North American forms now known, with the names used for them by Harrison Allen in 1864, Dobson in 1878 and Harrison Allen in 1893, are as follows:

Comparative table of names used for North American Vespertilionidæ.

Names used in the present paper.	H. Allen, 1864.	Dobson, 1878.	H. Allen, 1893.
Antrozous pallidus (Le Conte)	Antrozous pallidus (part).		Antrozous pallidus (part).
Antrozous pallidus pacificus Merriam.	Antrozous pallidus (part).	Antrozous pallidus	Antrozous pallidus (part).
Euderma maculatum (J. A. Allen).			Euderma maculata.
Corynorhinus macrotis (Le Conte).	Synotus macrotis		Corynorhinus macrotis.
Corynorhinus macrotis pallescens subsp. nov.	Synotus townsendi		Corynorhinus townsendi.
Corynorhinus macrotis townsendi (Cooper).		Plecotus macrotis	
Myotis velifer (J. A. Allen)			Vespertilio albescens velifer (part).
Myotis lucifugus (Le Conte).	Vespertilio lucifugus.	Vespertilio carolii	Vespertilio gryphus lucifugus. Vespertilio albescens affinis.

Comparative table of names used for North American Vespertilionidæ—Continued.

Names used in the present paper.	H. Allen, 1864.	Dobson, 1878.	H. Allen, 1893.
Myotis lucifugus longicrus (True).	....	....	Vespertilio nitidus longicrus.
Myotis lucifugus alascensis subsp. nov.	....	....	
Myotis yumanensis (H. Allen)	Vespertilio yumanensis.	....	Vespertilio albescens. Vespertilio nitidus macropus. Vespertilio nitidus (pedomorphic variety).
Myotis yumanensis saturatus. subsp. nov.	....	....	
Myotis californicus (Aud. & Bach.).	Vespertilio nitidus....	Vespertilio nitidus ...	Vespertilio nitidus. Vespertilio nitidus henshawi. Vespertilio albescens melanorhinus. Vespertilio nigricans (part).
Myotis californicus ciliolabrum (Merriam).	....	....	Vespertilio nitidus ciliolabrum.
Myotis californicus caurinus subsp. nov.	....	....	
yotis californicus mexicanus (Saussure).	....	....	
Myotis nigricans (Maximilian).	....	Vespertilio nigricans .	Vespertilio nigricans (part).
Myotis subulatus (Say)......	Vespertilio subulatus.	Vespertilio subulatus.	Vespertilio gryphus (northern form).
Myotis subulatus keenii (Merriam).	....	....	
Myotis evotis (H. Allen).....	Vespertilio evotis.....	Vespertilio evotis	Vespertilio albescens evotis.
Myotis thysanodes sp. nov...	....	....	Vespertilio albescens velifer (part).
Lasionycteris noctivagans (Le Conte).	Scotophilus noctivagans.	Vesperugo noctivagans.	Lasionycteris noctivagans.
Pipistrellus hesperus (H. Allen).	Scotophilus hesperus.	....	Vesperugo hesperus.
Pipistrellus hesperus australis subsp. nov.	....	....	
Pipistrellus subflavus (F. Cuvier).	Scotophilus georgianus.	Vesperugo georgianus	Vesperugo carolinensis.
Pipistrellus subflavus obscurus subsp. nov.	....	....	
Pipistrellus veræcrucis (Ward).	....	....	
Vespertilio fuscus Beauvois.	Scotophilus fuscus....	Vesperugo serotinus var. Vesperus fuscus.	Adelonycteris fuscus.
Vespertilio fuscus miradorensis (H. Allen).	....	....	
Vespertilio fuscus propinquus (Peters).	....	Vesperugo propinquus	
Vespertilio fuscus bahamensis subsp. nov.	....	....	
Vespertilio fuscus cubensis (Gray).	....	....	
Vespertilio albigularis (Peters).	....	Vesperugo albigularis	
Lasiurus borealis (Müller)...	Lasiurus noveboracensis.	Atalapha noveboracensis.	Atalapha noveboracensis.
Lasiurus borealis seminolus (Rhoads).	....	....	
Lasiurus borealis pfeifferi (Gundlach).	....	Atalapha noveboracensis var. pfeifferi.	
Lasiurus borealis teliotis (H. Allen).	....	....	Atalapha teliotis.

Comparative table of names used for North American Vespertilionidæ—Continued.

Names used in the present paper.	H. Allen, 1864.	Dobson, 1878.	H. Allen, 1893.
Lasiurus borealis mexicanus (Saussure).	....	Atalapha noveboracensis var. frantzii.	
Lasiurus cinereus (Beauvois)	Lasiurus cinereus	Atalapha cinerea	Atalapha cinerea.
Dasypterus intermedius H. Allen.	Lasiurus intermedius.	Atalapha intermedia..	Dasypterus intermedius.
Nycticeius humeralis Rafinesque.	Nycticejus crepuscularis.	Nycticejus crepuscularis.	Nycticejus humeralis.
Nycticeius humeralis cubanus (Gundlach).	....	....	
Rhogeëssa tumida H. Allen..	....	Vesperugo parvulus..	
Rhogeëssa parvula H. Allen.	....	....	
Rhogeëssa gracilis sp. nov...	....	....	
Rhogeëssa alleni Thomas....	....	....	

List of North American Vespertilionidæ, with type localities.

Name of species	Type locality.
Antrozous pallidus (Le Conte)	El Paso, Texas.
Antrozous pallidus pacificus Merriam	Old Fort Tejon, Cañada de las Uvas, California.
Euderma maculatum (J. A. Allen)..........	Near Piru, Ventura County, California.
Corynorhinus macrotis (Le Conte)...........	Georgia (probably near Riceboro).
Corynorhinus macrotis pallescens subsp. nov.	Keam Cañon, Navajo County, Arizona.
Corynorhinus macrotis townsendi (Cooper)..	Columbia River, Oregon.
Myotis velifer (J. A. Allen)................	Santa Cruz del Valle, near Guadalajara, Jalisco, Mexico.
Myotis lucifugus (Le Conte)...............	Georgia (probably near Riceboro).
Myotis lucifugus alascensis subsp. nov.....	Sitka, Alaska.
Myotis lucifugus longicrus (True)..........	Puget Sound.
Myotis yumanensis (H. Allen)	Old Fort Yuma, California.
Myotis yumanensis saturatus subsp. nov....	Hamilton, Washington.
Myotis californicus (Aud. & Bach.).........	California.
Myotis californicus caurinus subsp. nov....	Massett, Queen Charlotte Islands, British Columbia.
Myotis californicus ciliolabrum (Merriam)..	Trego County, Kansas.
Myotis californicus mexicanus (Saussure)...	Mexico (probably Vera Cruz, Puebla, or Oaxaca).
Myotis nigricans (Maximilian).............	Fazenda de Aga, near Iritiba River, Brazil.
Myotis subulatus (Say)....................	Arkansas River, near La Junta, Colorado.
Myotis subulatus keenii (Merriam).........	Massett, Queen Charlotte Islands, British Columbia.
Myotis evotis (H. Allen)..................	Monterey, California.
Myotis thysanodes sp. nov.................	Old Fort Tejon, California.
Lasionycteris noctivagans (Le Conte).......	Eastern United States (exact locality unknown).
Pipistrellus hesperus (H. Allen)...........	Old Fort Yuma, California.
Pipistrellus hesperus australis subsp. nov...	Barranca Ibarra, Jalisco, Mexico.
Pipistrellus subflavus (F. Cuvier)	Georgia (probably near Riceboro).
Pipistrellus subflavus obscurus subsp. nov ..	Lake George, New York.
Pipistrellus veræcrucis (Ward)	Las Vegas, Jalapa, Vera Cruz, Mexico.
Vespertilio fuscus Beauvois.................	Philadelphia, Pennsylvania.
Vespertilio fuscus miradorensis (H. Allen)..	Mirador, Vera Cruz, Mexico.
Vespertilio fascus propinquus (Peters)......	Santa Ysabel, Guatemala.

List of North American Vespertilionidæ, with type localities—Continued.

Name of species.	Type locality.
Vespertilio fuscus bahamensis subsp. nov	Nassau, New Providence, Bahamas.
Vespertilio fuscus cubensis (Gray)	Cuba.
Vespertilio albigularis (Peters)	Mexico.
Lasiurus borealis (Müller)	New York.
Lasiurus borealis seminolus (Rhoads)	Tarpon Springs, Florida.
Lasiurus borealis pfeifferi (Gundlach)	Cuba.
Lasiurus borealis teliotis (H. Allen)	California.
Lasiurus borealis mexicanus (Saussure)	Mexico (probably Vera Cruz, Puebla, or Oaxaca).
Lasiurus cinereus (Beauvois)	Philadelphia, Pennsylvania.
Dasypterus intermedius H. Allen	Matamoras, Tamaulipas, Mexico.
Nycticeius humeralis Rafinesque	Kentucky.
Nycticeius humeralis cubanus (Gundlach)	Cuba.
Rhogeëssa tumida H. Allen	Mirador, Vera Cruz, Mexico.
Rhogeëssa parvula H. Allen	Tres Marias Islands, Mexico.
Rhogeëssa gracilis sp. nov	Piaxtla, Puebla, Mexico.
Rhogeëssa alleni Thomas	Santa Rosalia, near Autlan, Jalisco, Mexico.

DESCRIPTIONS.

FAMILY VESPERTILIONIDÆ.

Characters.—Bats with turbinal bones folded, bony palate defective anteriorly owing to the absence of palatal processes to the premaxillæ (fig. 2*b*); molars with conspicuous W-shaped cusps; tail included nearly to tip in large interfemoral membrane; muzzle and nostrils variable, but former never provided with distinct noseleaf.

Remarks.—The family as thus defined is represented in North America by three well-marked subordinate groups, each of which may be ranked as a subfamily. Specimens from the region in question may be referred to their proper groups by the following wholly artificial key.

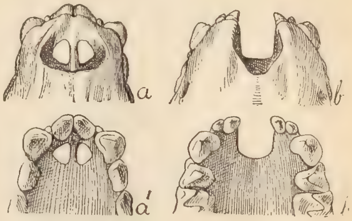


FIG. 2.—Anterior part of rostrum of species of (*a*) *Phyllostomatidæ* and (*b*) *Vespertilionidæ* (× 3).

KEY TO THE SUBFAMILIES OF NORTH AMERICAN VESPERTILIONIDÆ.

Lower incisors 4 .... *Antrozoinæ* (p. 41)
Lower incisors 6.
  Ears joined at anterior base .... *Plecotinæ* (p. 46)
  Ears separate .... *Vespertilioninæ* (p. 54)

Subfamily ANTROZOINÆ.

This subfamily is represented by the genus *Antrozous* peculiar to southwestern North America. Its members may therefore be recognized by their generic characters.

Genus ANTROZOUS H. Allen.

1862. *Antrozous* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 247.
1864. *Antrozous* H. Allen, Monogr. N. Am. Bats, p. 67.
1878. *Antrozous* Dobson, Catal. Chiroptera Brit. Mus., p. 170.
1893. *Antrozous* H. Allen, Monogr. Bats N. Am., p. 64.

Type species.—*Antrozous pallidus* (Le Conte).

Geographic distribution.—Austral zones from Texas to the Pacific, and from the Columbia River to Queretaro on the tableland of Mexico.

Generic characters.—Dental formula: $i, \frac{1\text{-}1}{2\text{-}2}; c, \frac{1\text{-}1}{1\text{-}1}; pm, \frac{1\text{-}1}{2\text{-}2}; m, \frac{3\text{-}3}{3\text{-}3} = 28$; mammæ 2; muzzle truncate; nostrils surrounded by a horseshoe-shaped ridge (fig. 3); lower lip free in front.

Remarks.—The genus *Antrozous* differs so widely from all others occurring in America that it needs no comparison with any of these. In many ways, however, it resembles *Nyctophilus* of the Old World.[1] While adult *Antrozous* invariably has only two lower incisors in each mandible, an immature individual from Silver City, N. Mex., has a third on the right side (fig. 4). The outer lower incisor is probably normally present in the young, though very early crowded out by the growth of the others.

One species and one subspecies are known, both of which occur in the United States.

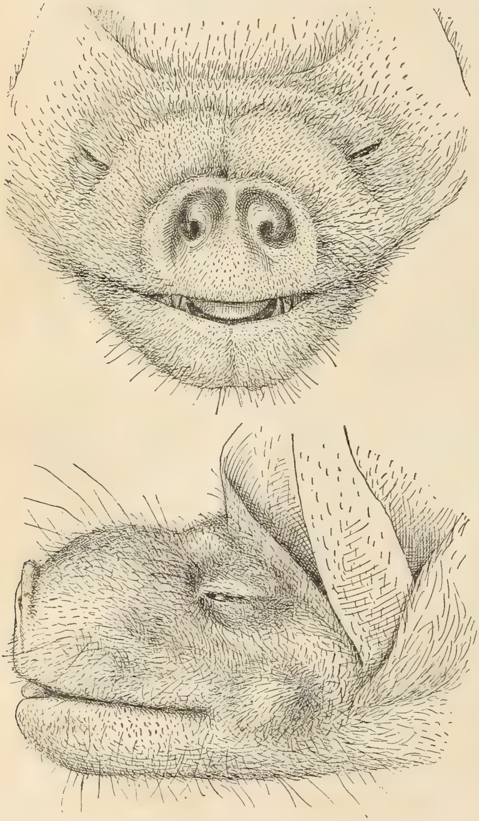


FIG. 3.—Muzzle of *Antrozous pallidus* (× 2).

KEY TO THE SUBSPECIES OF ANTROZOUS.

Forearm 48 mm. to 53 mm.; color, whitish drab-gray ....*pallidus* (p. 43)
Forearm 56 mm. to 60 mm.; color, pale yellowish, drab-brown ....*pacificus* (p. 45)

---

[1] See H. Allen, Monogr. Bats N. Am. (1893), p. 65.

ANTROZOUS PALLIDUS (Le Conte). Pale Bat.

1856. *Vespertilio pallidus* Le Conte, Proc. Acad. Nat. Sci. Phila., VII (1854–1855) p. 437.
1862. *Antrozous pallidus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 247.
1864. *Antrozous pallidus* H. Allen, Monogr. N. Am. Bats, p. 68 (part).
1878. *Antrozous pallidus* Dobson, Catal. Chiroptera Brit. Mus., p. 171 (part).
1893. *Antrozous pallidus* H. Allen, Monogr. Bats N. Am., p. 66 (part).

Type locality.—El Paso, Texas. (Type No. 5467, U. S. National Museum.)

Geographic distribution.—Lower Austral zone throughout the desert region of eastern California, Nevada, Arizona, New Mexico, and western Texas.

General characters.—Size large (average length of forearm about 50 mm.); ears large, reaching 20 mm. beyond tip of nose when laid forward; color very pale drab-gray.

Ears.—The ears (Pl. I, fig. 10) are larger than in any other North American *Vespertilionidæ* except the species of *Plecotinæ.* Laid forward they extend about 20 mm. beyond the tip of the nose. The anterior bases are rather close together, but separate. In form the ear is so simple as to call for no very detailed description. Anterior border strongly convex immediately above well-marked anterior lobe, then almost straight to narrowly rounded-off tip. Posterior border slightly concave immediately below tip, then gently convex to base. Posterior basal lobe very slightly developed. A transverse ridge 4 mm. in length extends obliquely upward and forward from near posterior base of tragus.

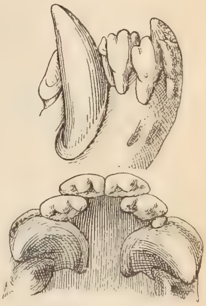


FIG. 4.—Abnormal front teeth of *Antrozous pallidus*, showing three incisors on right side. No. 60119 from Silver City, N. Mex. (× 10).

Tragus long, straight, and slender. Anterior border nearly straight to narrow tip. Posterior border at first almost parallel with anterior border, then slightly convex to notch above well-developed basal lobe. Whole posterior margin of tragus faintly crenulate.

Membranes.—The membranes are thick and leathery, much more so than in any of the North American *Vespertilioninæ* which approach this species in size. Wing membranes attached at base of toes; interfemoral membrane at base of terminal caudal vertebra. Free border of interfemoral membrane considerably longer than calcar.

Feet.—The feet are broad and strong, about half as long as tibia. Toes armed with large claws and sprinkled with a few short hairs on dorsum of phalanges.

Fur and color.—The fur is sparse and short, that on middle of back only about 8 mm. in length. It is closely confined to the body, and extends on ears and membranes in a narrow border along extreme base only.

On the back the fur is pale drab gray, most of the hairs with faintly dusky tips. Belly grayish white, tinged with drab on sides.

Skull.—The skull of typical *Antrozous pallidus* (fig. 5) varies in greatest length from 18 mm. to 20 mm., and in zygomatic breadth from 11 mm. to 12.5 mm. Brain case, rostrum, and palate broad. Length of bony palate behind molars (exclusive of median spine) usually less than width at base of median spine.

Teeth.—The teeth (fig. 6 *a*) are large and strong. Upper premolar transversely long and narrow. First lower premolar small and closely wedged between canine and second premolar.

Measurements.—See table, page 46.

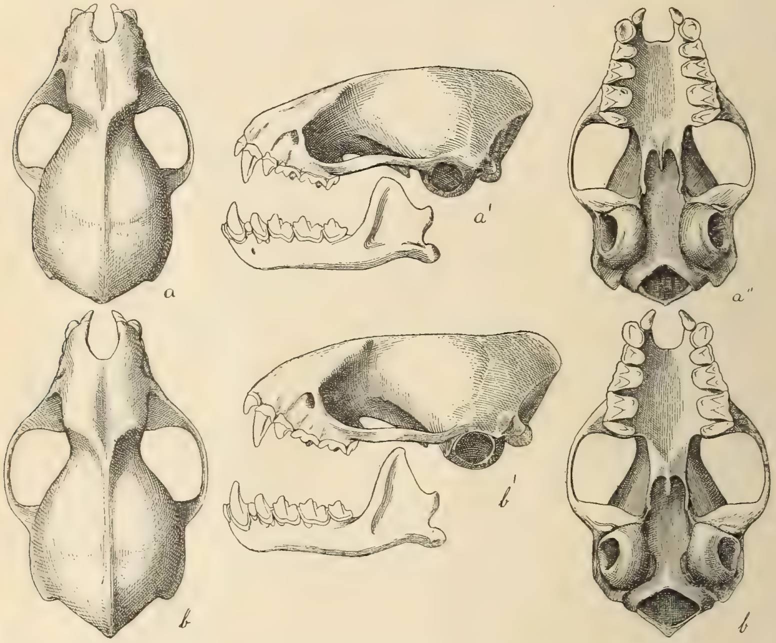


Fig. 5.—Skulls of (*a*) *Antrozous pallidus* and (*b*) *Antrozous pallidus pacificus* (× 2).

Specimens examined.—Total number, 64, from the following localities:

Arizona: Mouth of Colorado River, 1; Yuma, 5.
California: Old Fort Yuma, 1; Owens Valley, 2; Panamint Valley, 1; Walker Basin, 2.
Nevada: Amargosa Desert, 1; Timpahute Mountains, 2.
New Mexico: Silver City, 4 (skins).
Texas: Comstock, 6; Devils River, 8; El Paso, 1 (skin, type); Fort Hancock, 20 (3 skins); Painted Cave, 3; Paisano, 1; Sycamore Creek, 6.

General remarks.—In the original description of *Antrozous pallidus* the animal is said to be a native of California, but both Baird[1] and Harrison Allen[2] have shown that the type specimen came from El Paso,

---

[1] Rept. Mex. Bound. Surv., II, p. 5, 1859.

[2] Monogr. N. Am. Bats, p. 69, 1864.

Texas. The type, now in the United States National Museum, is in good preservation and clearly referable to the Eastern form.

Typical *Antrozous pallidus* is readily distinguishable from *A. p. pacificus* by its smaller size, paler color, shorter, broader skull, and narrower upper premolar.

ANTROZOUS PALLIDUS PACIFICUS Merriam.

1864. *Antrozous pallidus* H. Allen, Monogr. N. Am. Bats, p. 68 (part).
1878. *Antrozous pallidus* Dobson, Catal. Chiroptera Brit. Mus., p. 171 (part).
1893. *Antrozous pallidus* H. Allen, Monogr. Bats. N. Am., p. 66 (part).
1897. *Antrozous pallidus pacificus* Merriam, Proc. Biol. Soc. Washington, XI, p. 180, July 1, 1897.

Type locality.—Old Fort Tejon, Cañada de las Uvas, California.

Geographic distribution.—Austral zones in the United States west of the Rocky Mountains, south to Lower California and Queretaro.

General characters.—Slightly larger than typical *Antrozous pallidus* (total length about 120 mm., average length of forearm about 54 mm.); color, yellowish drab-brown.

Ears, membranes, and distribution of fur.—Essentially as in typical *pallidus*.

Color.—Color uniform yellowish drab throughout to base of hairs; under parts clear and unmixed with darker; back strongly but irregularly shaded by the dusky tips of the hairs.

Skull.—The skull of *Antrozous pallidus pacificus* (fig. 5 *b*) varies in greatest length from 20 mm. to 22 mm., and in zygomatic breadth from 13 mm. to 14 mm. Brain case, rostrum, and bony palate considerably narrower than in typical *pallidus*. Supraoccipital region more pointed and overhanging than in typical *pallidus*. Length of bony palate behind molars (exclusive of median spine) usually equal to or greater than width at base of median spine.

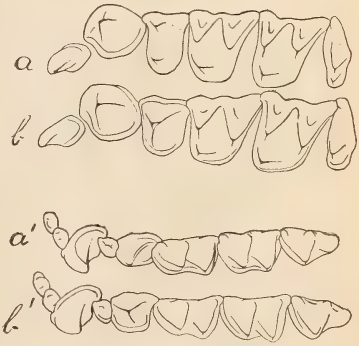


FIG. 6.—Teeth of (*a*) *Antrozous pallidus* and (*b*) *Antrozous pallidus pacificus* (× 5).

Teeth.—Teeth (fig. 6 *b*) essentially as in true *pallidus* except that all are larger and the upper premolar is conspicuously broader and shorter.

Measurements.—See table, page 46.

Specimens examined.—Total number, 59, from the following localities:

California: Alhambra, 1; Bear Valley, 8; Berkeley, 1; Dulzura, 6; Fort Crook, 1; Fresno, 3; Old Fort Tejon, 6; Poso Creek, 1 (skin); Santa Barbara, 3; Santa Ysabel, 4 (3 skins); Witch Creek, 2.
Lower California: Cape St. Lucas, 3; Comondu, 5 (skins); San Fernando, 5 (Miller coll.).
Oregon: Fort Dalles, 1 (skin); Twelve Mile Creek, 1.
Queretaro: Jalpan, 7.
Utah: St. Thomas, 1.

General remarks.—Antrozous pallidus pacificus needs no comparison with typical *pallidus* further than that already given under the latter.

Average measurements of subspecies of Antrozous pallidus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
pallidus	Texas: El Paso..................	1 [1]	....	....	20.5	10	49	9	92	....	....	....
	Comstock..................	4 ♀♀	105	44.2	21	10	51	8.5	85	28	18.4	11.6
	Fort Hancock..............	4 ♀♀	115	46	20	10	49	8.3	86	30	20	14
	Sycamore Creek	6 ♀♀	109	44.6	20.6	10	51	8.9	88	28.5	18.6	13
pacificus	Queretaro: Jalpan..................	6 ♀♀	114	47.8	22.6	10.8	54.5	9.4	93	30	19	14
	California: Santa Ysabel	4 ♂♂	....	....	22	11	54.5	9.5	94	....	....	....
	Dulzura..............	4 ♀♀	118	46.7	22.2	11	53.5	9.5	91	30	19	13
	Oregon: Fort Dalles	1 ?	....	....	21	11	55	9	96	....	....	....
	Twelve Mile Creek	1 ?	....	....	20	12	56	10	93	....	....	....

[1] Type.

Subfamily PLECOTINÆ.

This subfamily is represented in North America by two genera, *Corynorhinus* and *Euderma* which may be recognized among the other *Vespertilionidæ* of the region by their huge ears, joined together across the forehead. None of the North American *Vespertilioninæ* show this peculiarity.

Genus EUDERMA H. Allen.

1891. *Histiotus* J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 195 (not Gervais 1855).

1892. *Euderma* H. Allen, Proc. Acad. Nat. Sci. Phila., 1891, p. 467, Jan. 12, 1892.

1893. *Euderma* H. Allen, Monogr. Bats N. Am., p. 60.

Type species.—Euderma maculatum (J. A. Allen).

Geographic distribution.—The genus *Euderma* is at present known from one specimen taken in Ventura County, California.

Generic characters.—Dental formula: $i, \frac{2\text{-}2}{3\text{-}3}$; $c, \frac{1\text{-}1}{1\text{-}1}$; $pm, \frac{2\text{-}2}{2\text{-}2}$; $m, \frac{3\text{-}3}{3\text{-}3} = 34$. Ears (Pl. I, fig. 11) even larger than in *Corynorhinus*, joined together across forehead and with posterior base of tragus united with external basal lobe. Face without evident glandular swellings.

Remarks.—The genus *Euderma* resembles *Corynorhinus* more closely than any other American bat, but differs in the presence of two less premolars, in the simple nostrils, and in the more complicated structure of the ear. Only one species is known.

EUDERMA MACULATUM (J. A. Allen).

1891. *Histiotus maculatus* J. A. Allen, Bull. Am. Mus. Nat. Hist., III, p. 195, February 20, 1891.

1893. *Euderma maculata* H. Allen, Monogr. Bats N. Am., p. 61.

Type locality.—Near Piru, Ventura County, California (probably at mouth of Castac Creek[1]). Type in American Museum of Natural History (No. $\frac{3920}{2991}$.) Skull now lost.

Geographic distribution.—Euderma maculatum is known from the type locality only.

General characters.—Size large; ears about three-fourths as long as forearm; color blackish blotched with white.

Ears.—Ears very large (Pl. I, fig. 11), fully three-fourths as long as forearm, joined together across forehead by a low band of membrane; anterior basal lobe continuous with keel which extends upward from anterior base of tragus and fades into substance of ear at about terminal part of lower fourth, beyond which it continues to tip as a well-defined line; anterior border of ear nearly straight through lower half, then gently convex to broadly rounded off tip; posterior border slightly concave immediately below tip, then convex to base; posterior basal lobe joined to base of tragus by a low band, below which a distinct pocket is formed; back of this band a conspicuous ridge extending inward toward meatus; ear membrane marked by about fifteen transverse ridges; anterior margin of ear sprinkled with whitish hairs.

Tragus nearly straight on anterior border, convex on posterior border except at posterior base, where it is straight for a distance of 2 mm. (the resulting form strongly suggests a table knife with short blade).

Membranes.—The membranes are broad and ample, the wing membrane (Pl. III, fig. 3) attached at base of toes, the interfemoral membrane at base of terminal caudal vertebra. Free border of interfemoral membrane apparently longer than calcar.

Feet.—The feet are moderately large, a little less than half as long as tibia. Toes sparsely sprinkled with short bristly hairs on dorsal surface and armed with strong claws. Calcar indistinct in the dried skin, but apparently short and without keel or terminal lobule.

Fur and color.—The fur is full and soft, about 12 mm. in length on middle of back. It extends on extreme base of ear, and on membranes forms a very narrow border close to body.

Back very dark sepia, almost black; occiput and fore part of neck distinctly less dark; hairs on sides and on middle of back faintly annulated with gray near tips; patch at base of tail and on each shoulder pure white; whole ventral surface of body white, the blackish bases of the hairs showing through irregularly; fur everywhere blackish at base; ears and membranes light brown.

Skull and teeth.—As the skull of *Euderma maculatum* is lost, I quote the descriptions published by Dr. J. A. Allen and Dr. Harrison Allen. The former writes:

> *Skull and dentition.*—Basilar length, 16.5 mm. (0.65 in.); total length, 19 mm. (0.75 in.); zygomatic width, 10.9 mm. (0.43 in.); height, 7.6 mm. (0.30 in.); length of

---

[1] This information was given to members of a Biological Survey party by the collector of the type specimen.

lower jaw, 12.7 mm. (0.50 in.); height at condyle, 3.3 mm. (0.13 in.); height at coronoid process, 3.8 mm. (0.15 in.); length of upper tooth row, 6.86 mm. (0.27 in.); length of lower tooth row, 7.6 mm. (0.30 in.).

Dental formula: incisors, $\frac{2-2}{6}$; canines, $\frac{1-1}{1-1}$; premolars, $\frac{1-1}{2-2}$; molars, $\frac{3-3}{3-3} = \frac{14}{18} = 32$.

The skull is thin and papery, being evidently that of a young animal. The facial portion is narrow and pointed; the brain case is quadrate, flattened above, but rises abruptly at the frontal border, the forehead being suddenly depressed.

The lower border of the zygomatic arch is curved upward; the upper border is greatly expanded vertically, the upper border of the malar forming a high angular process at the middle of arch; the zygomatic process of the squamosal is short, and, with the malar, passes forward in a line nearly parallel with the axis of the skull, with only a very slight outward curvature. The tympanic bullæ are enormously expanded, having an antero-posterior length of 5.84 mm. (0.23 in.), and a transverse breadth of 3.3 mm. (0.13 in.), their length fully equaling one-third of the length of the skull. In other respects the ventral aspect of the skull presents nothing peculiar. The lower jaw is narrow, the coronoid process small, rising but little above the condyle; the angle is well developed.

The dentition is weak, the incisors and canines being very small, relatively to the molar series. The outer upper incisor is about one-half the size of the inner; both have a small outer cusp at the base. The upper canine is about equal in size to the anterior half of the upper premolar. The molars present nothing distinctive. The lower incisors are slightly double-notched (trifid); the lower canines are very small; the first premolar is about half the size of the second.

In his original account of the genus *Euderma*, Dr. Harrison Allen describes the skull and teeth as follows:

Skull.—Brain-case low, quadrate, the height one-half the bimastoid diameter. The metencephalon as long as mesencephalon and pro-encephalon. Sagittal crest rudimentary, does not extend beyond a line answering to the middle of the zygoma—the remaining portions of the posterior temporal crest widely separated—the anterior not defined. Dorsum of face-vertex with a shallow concavity which is not sharply defined; orbit with inflated inner wall and rugose elevated upper border; lachrymal tubercle marked. Infra-orbital canal short; the foramen on line with interval between second premolar and first molar. Line of the upper margin of the anterior nasal aperture if produced would intersect the second premolar; tympanic bone apparently incomplete above.

The paroccipital process bold, trenchant; sterno-mastoid impression deeply concave; mastoid composed entirely of the squamosal element. Zygoma quite as in *Corynorhinus*—the squamosal part twice as wide as maxillary; spheno-palatine foramen present, of large size. Occipital crest trenchant. Tympanic bone greatly inflated, equals one-third the length of the skull, not touching basi-occipital, or basi-sphenoid; excavate anteriorly. It extends to a line which answers to the middle of the glenoid cavity. The mesopterygoid fossa as long as one-third the distance from the posterior palatal border to the incisors. The sphenoidal foramen is at the bottom of a deep recess. The coronoid process is round, small, raised scarcely one-third the height of the ascending ramus; lower border of the horizontal ramus near the angle slightly concave. The angle is raised from the plane on which the mandible rests. * * *

Upper teeth.—Incisors contiguous, slightly inclined toward the median line, but the lateral tooth separated from the canine by a moderate interval. Central incisor cuspidate, with a small cuspule projected midway on the posterior surface; a distinct cuspule also arises from the cingulum posteriorly. Lateral incisor one-half the size of the central, and cuspidate, with a small cuspule arising from the cingulum on the anterior and a second on the posterior portion. Canine not larger than the second premolar, the buccal surface is abruptly convex. The first premolar is small, not wedged in, with complete cingulum. The space between it and canine narrower than that between it and second premolar. The second premolar as long as the canine and slightly fluted. Molars as in *Corynorhinus*.

Lower teeth.—Incisors crowded, trifid, i. e., the main cusp possesses a well-developed cuspule on each side of the base, the cingulum on the posterior side being large. The first and second teeth overlap for a distance equaling one-half of their diameters. The third incisor retains a posterior cuspule which is larger than the anterior and separated from the main cusp by a wide interval. The canine is small and projects but a slight degree above the incisors. It exhibits a marked cuspule on the cingulum anteriorly.

Measurements (from skin).—Total length, 110; tail vertebræ, 50; tibia, 21; foot, 9; forearm, 50; thumb, 6.8; longest finger, 91; ear from meatus, 34; width of ear, 22; tragus, 13; greatest width of tragus, 5.

Specimens examined.—One, the type (Am. Mus. Nat. Hist., New York).

General remarks.—*Euderma maculatum* differs so widely from all other known bats that no comparison with any is necessary. Its peculiar color at first suggests albinism, but since the fur is everywhere dark at base, even in the white areas, the pattern is probably normal. It is useless to hazard any conjecture as to its probable geographic range or exact faunal position.

The following note on this bat is kindly furnished by Dr. C. Hart Merriam:

> The type of this remarkable genus and species, recently described by Dr. J. A. Allen, is believed to have been obtained at the mouth of Castac Creek in the Santa Clara Valley, near San Fernando, Cal. The type specimen remains the only one thus far collected, but the species probably ranges over much of the Lower Sonoran Desert region in summer. While in Vegas Valley, Nev., I was told by the Stuarts, the owners of Vegas Ranch, that a very large bat "with ears like a jackass and a white stripe on each shoulder" is abundant at that place in the summer, but does not occur in spring or fall. They stated that it had not yet arrived at the date of our visit, May 1, 1891.

Genus CORYNORHINUS H. Allen.

1831. *Plecotus* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, Appendix, p. 431 (not *Plecotus* Geoffroy 1818).
1864. *Synotus* H. Allen, Monogr. N. Am. Bats, p. 62 (not *Synotus* Keyserling & Blasius 1839).
1865. *Corynorhinus* H. Allen, Proc. Acad. Nat. Sci., Phila., p. 173.
1878. *Plecotus* Dobson, Catal. Chiroptera Brit. Mus., p. 177 (part).
1893. *Corynorhinus* H. Allen, Monogr. Bats N. Am., p. 53.

Type species.—*Corynorhinus macrotis* (Le Conte).

Geographic distribution.—Austral zones throughout the United States, and in Mexico south at least to Vera Cruz. Limits of range imperfectly known.

Generic characters.—Dental formula:

$$i, \frac{2-2}{3-3}; \quad c, \frac{1-1}{1-1}; \quad pm, \frac{2-2}{3-3}; \quad m, \frac{3-3}{3-3} = 36.$$

Skull (fig. 8, p. 52) slender and highly arched, the rostral portion relatively smaller and weaker than in any other North American genus of the family (with the possible exception of *Euderma*, the only known skull of which is now lost). Ears very long, (Pl. I, fig. 9), joined together across forehead, and with tragus free from external basal lobe. Region between eye and nostril occupied by a prominent thickened ridge which terminates in a conspicuous club-shaped enlargement (fig. 7). First phalanx of third finger shorter than second (Pl. III, fig. 2).

General remarks.—*Corynorhinus* differs widely from the other known American genera of *Vespertilionidæ*, but somewhat closely resembles the Old World *Plecotus*. From the latter it is separated by its differently formed nostrils, conspicuously glandular muzzle, and differently proportioned fingers (fig. 7, and Pl. III, figs. 1 and 2). The genus is represented by one species which may be divided into three subspecies, differing from each other chiefly in color. All of these occur in the United States. The material by which this genus is now represented in collections is very unsatisfactory.

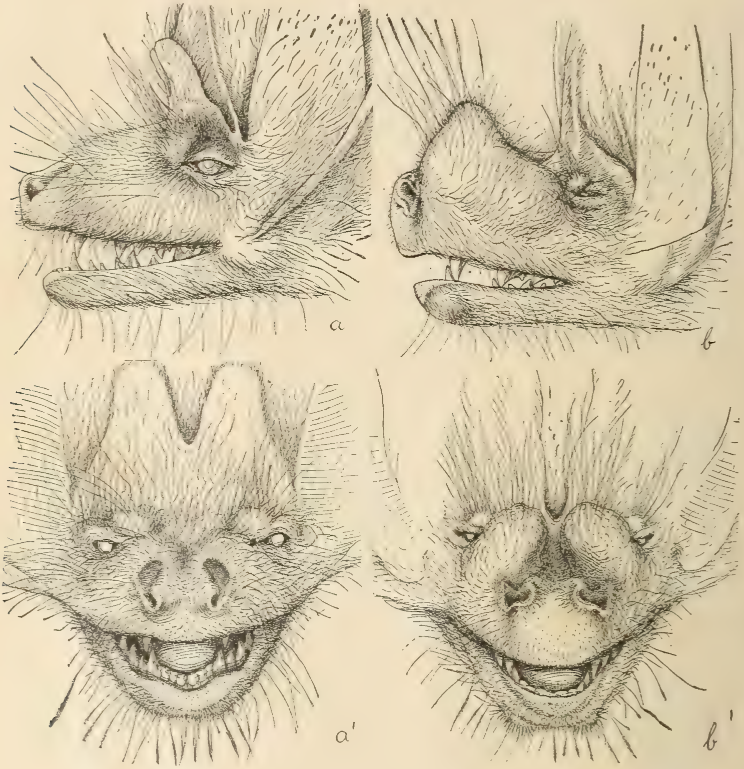


FIG. 7.—Muzzles of (*a*) *Plecotus* and (*b*) *Corynorhinus* (×2).

KEY TO THE SUBSPECIES OF CORYNORHINUS.

Fur everywhere distinctly bicolor .... *macrotis* (p. 51)
Fur not distinctly bicolor.
    Color yellowish gray .... *pallescens* (p. 52)
    Color blackish brown .... *townsendii* (p. 53)

CORYNORHINUS MACROTIS (Le Conte). Big-eared Bat.

1831. *Plecotus macrotis* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, Appendix, p. 431 (Georgia).
1837. *Plecotus lecontii* Cooper, Ann. Lyc. Nat. Hist. N. Y., IV, p. 72. (Name proposed as substitute for *macrotis*.)
1864. *Synotus macrotis* H. Allen, Monogr. N. Am. Bats, p. 63.
1865. *Corynorhinus macrotis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 173.
1893. *Corynorhinus macrotis* H. Allen, Monogr. Bats N. Am., p. 55.

Type locality.—Georgia (see Proc. Acad. Nat. Sci. Phila., 1855, p. 434), probably near the Le Conte Plantation, 5 miles south of Riceboro.

Geographic distribution.—Lower Austral zone in the eastern United States.

General characters.—Size large (forearm 41 mm. to 42 mm., ear about 32); fur everywhere distinctly bicolor; general color yellowish brown.

Ears.—The ears of typical *Corynorhinus macrotis* do not appreciably differ from those of the other subspecies. They are so different from those of all other North American bats as scarcely to require detailed description. They may be instantly recognized by their length, much more than half that of forearm, and by the form of the tragus. This is simple, with a large basal lobe, and wholly free from the auricle. In *Euderma maculatum*, the only other North American bat with ears approaching those of *Corynorhinus* in size, the tragus is joined to the external basal lobe.

Membranes.—The membranes are broad and ample. In texture they are remarkably thin and delicate for so large a bat. Wings (Pl. III, fig. 2) attached at side of metatarsus just below base of toes. Uropatagium extending to extreme tip of tail.

Feet.—The feet are slender, less than half as long as tibiæ, and armed with strong claws. Calcar a little shorter than tibia, and about equal to free border of interfemoral membrane. It is without vestige of keel on posterior border. The termination is obscure and without lobule. Back of toes sprinkled with long bristly hairs.

Fur and color.—The fur is soft and silky, that on middle of back averaging about 12 mm. in length. In distribution it shows no striking peculiarities. It extends a short distance on the dorsal base of the ear, but scarcely reaches the wings or interfemoral membrane.

Back uniform yellowish brown, much as in *Myotis lucifugus;* the hairs everywhere sepia through a little more than the basal half and with very indistinctly pale tips. Belly grayish white; throat and chest darker and more tinged with yellowish. Throughout the ventral surface the fur is very sharply bicolor, the dark bases of the hairs considerably darker than on the back. The light tips are too short wholly to conceal the dark under fur. Ears and membranes light brown.

Skull and teeth.—The skull (fig. 8) and teeth (fig. 9) have been sufficiently described under generic characters. An adult skull from Houma, La. (♀ No. 45894, United States National Museum, Biological Survey collection), measures: Greatest length, 16; zygomatic breadth, 9; breadth of rostrum at posterior border of large premolar, 5; mandible, 10.6; upper tooth row (exclusive of incisors), 5.2; lower tooth row, 6.8.

Measurements.—See table, page 54.

Specimens examined.—Total number, 9, from the following localities:

Alabama: Greensboro, 1 (skin, Merriam coll.).
Kentucky: Bowling Green, 1.
Louisiana: Houma, 4 (skins).
Mississippi: Bay St. Louis, 1.
South Carolina: Hardeeville, 1 (skin, Miller coll.).
Virginia: Dismal Swamp, 1 (skin).

General remarks.—Typical *Corynorhinus macrotis*, like the western subspecies, is distinguishable at a glance from all other North American bats by its generic characters. Among the forms of *Corynorhinus* it may be distinguished by its conspicuously bicolored fur. The limits of this animal's range are not well understood, but it is probably a characteristic species of the Austroriparian fauna.

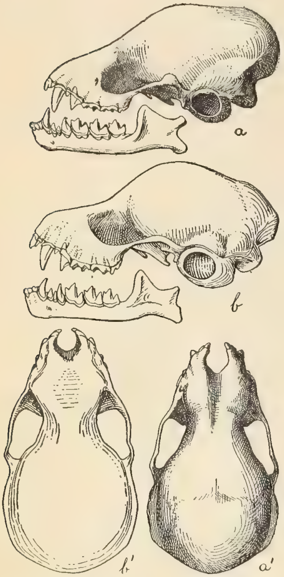


FIG. 8.—Skulls of (*a*) *Corynorhinus townsendii* and (*b*) *C. macrotis* (×2).

CORYNORHINUS MACROTIS PALLESCENS subsp. nov.

1864. *Synotus townsendi* H. Allen, Monogr. N. Am. Bats, p. 65 (not *Plecotus townsendi* Cooper, 1837),

1893. *Corynorhinus townsendi* H. Allen, Monogr. Bats N. Am., p. 58.

Type from Keam Cañon, Navajo County, Arizona. Adult ♀ (skin), No. 65534, U. S. National Museum (Biological Survey collection). Collected August 3, 1894, by Dr. A. K. Fisher. Collector's No., 1715.

Geographic distribution.—Probably throughout the Austral zones from California, Colorado, and western Texas to southern Mexico.

General characters.—Similar to typical *macrotis*, but much paler in color; fur nowhere distinctly bicolor.

Color.—Back yellowish drab gray, becoming paler about head, the hairs with faintly defined light plumbeous bases and faintly darker tips. Belly slightly paler than back, but hairs without distinctly lighter tips and with darker basal area so ill defined as to be scarcely visible. Ears and membranes light brown.

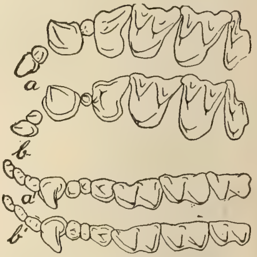


FIG. 9.—Teeth of (*a*) *Corynorhinus townsendii* and (*b*) *C. macrotis* (× 5).

Measurements.—See table, page 54.

Specimens examined.—Total number, 30, from the following localities:

Arizona: Fort Huachuca, 2; Keam Canyon, 1 (skin).
California: Dulzura, 1; Owens Lake, 1; Owens Valley, 1.

Colorado: Larimer County, 1 (skin, Miller coll.).
Guanajuato: Santa Rosa, 17.
Michoacan: Patzcuaro, 1.
Oaxaca: Oaxaca, 1.
San Luis Potosi: Hacienda La Parada, 1.
Texas: East Painted Cave, 1.
Utah: 1.
Vera Cruz: Jico, 1.

General remarks.—*Corynorhinus macrotis pallescens* differs from true *macrotis* in its much paler, more uniform coloration. While this form is represented in the National Museum by numerous specimens in alcohol, the series of skins is very incomplete. Until this series can be greatly increased the limits of distribution of the subspecies must remain purely a matter of conjecture.

The differences in form of the inner upper incisor which have been supposed to distinguish this race from true *macrotis*[1] appear to be inconstant. While the few specimens of typical *macrotis* that I have seen have this tooth without exception bicuspidate, western specimens vary greatly. In a series from Santa Rosa, Guanajuato, both extremes are represented, while several specimens are with difficulty referred to one or the other (fig. 10).

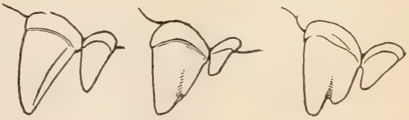


FIG. 10.—Left upper incisors of *Corynorhinus macrotis pallescens* from Santa Rosa, Guanajuato, Mexico.

This is the bat to which Dr. Harrison Allen has applied the name *townsendi*. True *townsendi*, however, the type of which came from the Columbia River, is the dark northwest coast form.

CORYNORHINUS MACROTIS TOWNSENDII (Cooper).

1837. *Plecotus townsendii* Cooper, Ann. Lyc. Nat. Hist., N. Y., IV, p. 73. (Columbia River.)

1878. *Plecotus macrotis* Dobson, Catal. Chiroptera Brit. Mus., p. 180 (not *Plecotus macrotis* Le Conte, 1831).

Type locality.—Columbia River, Oregon.

Geographic distribution.—Humid coast district of Oregon, Washington, and southern British Columbia.

General characters.—Similar to typical *macrotis*, but much darker; fur nowhere distinctly bicolor.

Color.—Back uniform dark brown, the hairs indistinctly light plumbeous at base, and very faintly tipped with yellowish. Belly dark brown, the hairs light plumbeous at base. Ears and membranes blackish.

Measurements.—See table, page 54.

Specimens examined.—Total number, 3, from the following localities:

British Columbia: Comox, 1 (skin).
Oregon: Creswell, 1; Gold Beach, 1.

---

[1] H. Allen, Monogr. Bats N. Am., p. 58, 1893.

General remarks.—Corynorhinus macrotis townsendii is the dark northwest coast representative of the species. In coloration it bears a close resemblance to the other bats peculiar to the same region. It is so different in general appearance from *macrotis* and *pallescens* that it needs no special comparison with them. More material is necessary before the exact relationship of this form to the others can be determined.

While this is the true *townsendii* of Cooper, it is not the bat to which Harrison Allen has applied the name. The latter is *C. macrotis pallescens*. It was on a specimen of this form from Vancouver Island that Dobson based his description of '*Plecotus*' *macrotis* in the Catalogue of Chiroptera in the British Museum.

Average measurements of subspecies of Corynorhinus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
macrotis	South Carolina: Hardeeville	1♀	....	...	21	10	41	7.4	73	....	....	....
	Kentucky: Bowling Green	1♂	105	52	22	10	43.4	7	77	32	23	14
	Louisiana: Houma	4♀♀	106	48.5	21.5	9.4	41.5	7.5	73	32	....	....
pallescens	Arizona: Keam Canyon	1♀[1]	105	49	20.6	9.6	42.6	6	76	....	....	....
	Fort Huachuca	1♂	95	45	19	9	....	6	71	33.4	21.4	14.6
	Colorado: Larimer County	1♀	....	....	21.6	9.6	44	7	77	....	....	....
	Texas: East Painted Cave	1♀	90	45	21	9.6	41	5	73	33	20	14.6
	Guanajuato: Santa Rosa	10	99.3	48.1	20	9	41.9	6.6	77	33.9	23.7	12.7
townsendii	British Columbia: Comox	1♀	....	....	21.4	10	42	6.6	76	....	....	....
	Oregon: Gold Beach	1♀	105	51	22	9.4	44	7	80	33	24	15
	Creswell	1♀	100	48	22	9.8	43	7	77	34	21	14

[1] Type.

Subfamily VESPERTILIONINÆ.

This subfamily contains the great majority of North American *Vespertilionidæ*. Those of its members that occur in the region in question may be known by their simple muzzles and nostrils, separate ears, ample interfemoral membranes, and six incisors in the lower jaw.

KEY TO GENERA OF VESPERTILIONINÆ OCCURRING IN AMERICA NORTH OF PANAMA.

[Based on dental characters only.]

Upper incisors 2.
  Upper premolars 2.
    Mandibular tooth-row more than 8 mm .... *Dasypterus* (p. 115)
    Mandibular tooth-row less than 7 mm.
      Third lower incisor much smaller than second or first .. *Rhogeëssa* (p. 122)
      Third lower incisor about equal to second or first .... *Nycticeius* (p. 118)
  Upper premolars 4 .... *Lasiurus* (p. 105)
Upper incisors 4.
  Upper premolars 2 .... *Vespertilio* (p. 95)
  Upper premolars more than 2.
    Upper premolars 4.
      Lower premolars 4 .... *Pipistrellus* (p. 87)
      Lower premolars 6 .... *Lasionycteris* (p. 85)
    Upper premolars 6 .... *Myotis* (p. 55)

Genus MYOTIS Kaup.

1829. *Myotis* Kaup, Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., I, p. 106. Type *Vespertilio murinus* Schreber (not *V. murinus* Linn.).
1829. *Nystactes* Kaup, Skizzirte Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., I, p. 108. Type *Vespertilio bechsteinii* Leisler.
1839. *Vespertilio* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 306 (not *Vespertilio* Linnæus, 1758).
1841. *Selysius* Bonaparte, Iconografia Fauna Italica, I, Introduzione [p. 3]. Type *Vespertilio mystacinus* Leisler.
1856. *Brachyotus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 174–177. Based on the species *mystacinus*, *daubentonii*, and *dasycneme*.

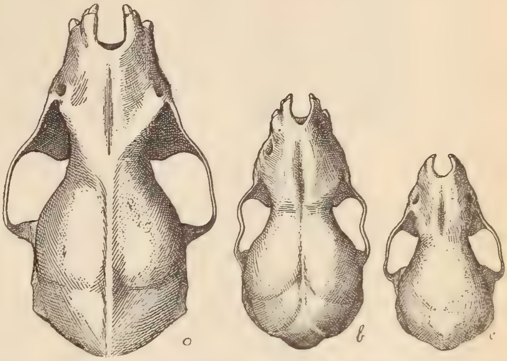


Fig. 11.—Skulls of (*a*) *Myotis myotis*, (*b*) *M. thysanodes*, and (*c*) *M. nigricans* (×2).

1856. *Isotus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 177–179. Included the species *nattereri* and *emarginatus*.
1864. *Vespertilio* H. Allen, Monogr. N. Am. Bats, p. 46. (Not *Vespertilio* Linn., 1758.)
1870. *Aeorestes* Fitzinger, Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth. I, pp. 427–436. Included the species *villosissimus*, *albescens*, and *nigricans*.
1870. *Comastes* Fitzinger, Sitzungsber. Math.-Nat. Cl. K. Akad. Wiss., Wien, LXII, Abth. I, pp. 565–579. (Included *capaccinii*, *megapodius*, *dasycneme* and *limnophilus*.)
1878. *Vespertilio* Dobson, Catal. Chiroptera Brit. Mus., p. 284 (not *Vespertilio* Linnæus 1758).
1893. *Vespertilio* H. Allen, Monogr. Bats N. Am., p. 70. (Not *Vespertilio* Linn., 1858).

Type species.—*Myotis myotis* (Bechstein) = *Vespertilio murinus* Schreber et Auct., nec Linn.

Geographic distribution.—Temperate and tropical parts of both hemispheres.

Generic characters.—Dental formula:

$$i,\ \frac{2-2}{3-3};\quad c,\ \frac{1-1}{1-1};\quad pm,\ \frac{3-3}{3-3};\quad m,\ \frac{3-3}{3-3}=38.$$

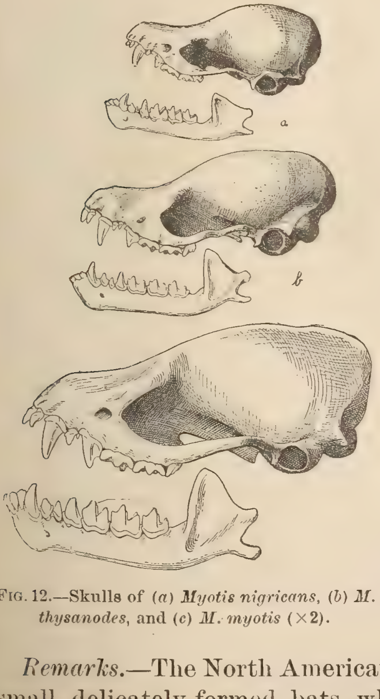


Fig. 12.—Skulls of (*a*) *Myotis nigricans*, (*b*) *M. thysanodes*, and (*c*) *M. myotis* (×2).

Remarks.—The North American members of the genus *Myotis* are all small, delicately formed bats, which, aside from their dental formula, shared by no other American genus of *Vespertilionidæ*, are usually recognizable by their slender forms, long tails, hairy faces, narrow ears, and tapering, straight, or recurved tragi. As I have had no opportunity to study any of the Old World species except *M. myotis*, I can make no attempt to define the genus in detail, but the dental formula, coupled with the characters of the family, is sufficient to distinguish the genus among American bats. The species of *Myotis* differ greatly among themselves, especially in size (see figs. 11 and 12). It may eventually prove necessary to divide the genus into two or more subgenera.

KEY TO NORTH AMERICAN FORMS OF MYOTIS.

- Free border of uropatagium conspicuously fringed .... *thysanodes* (p. 80)
- Free border of uropatagium not conspicuously fringed.
  - Forearm more than 40 mm.
    - Ear when laid forward extending barely beyond nostril .... *velifer* (p. 56)
    - Ear when laid forward extending 7 to 10 mm. beyond nostril .... *evotis* (p. 77)
  - Forearm less than 40 mm.
    - Ear when laid forward extending 7 to 10 mm. beyond nostril .... *evotis* (p. 77)
    - Ear when laid forward extending less than 6 mm. beyond nostril.
      - Fur on back not distinctly bicolor .... *nigricans* (p. 74)
      - Fur on back distinctly bicolor.
        - General color whitish gray.
          - Foot 8 to 10 mm .... *yumanensis* (p. 66)
          - Foot 5 to 7 mm .... *ciliolabrum* (p. 72)
        - General color never whitish gray.
          - Forearm 30 to 35 mm.
            - Color light yellowish gray .... *californicus* (p. 69)
            - Color yellowish brown.
              - Forearm 31 to 33 mm .... *caurinus* (p. 72)
              - Forearm 32 to 36 mm .... *mexicanus* (p. 73)
          - Forearm 34 to 40 mm.
            - Tibia less than 15 mm .... *saturatus* (p. 68)
            - Tibia 15 to 19 mm.
              - Ear and tragus slender, the latter 9 mm. or more in length.
                - Color light brown .... *subulatus* (p. 75)
                - Color blackish .... *keenii* (p. 77)
              - Ear and tragus short and broad, the latter 8 mm. or less in length.
                - Tibia 17.5 to 20 mm .... *longicrus* (p. 64)
                - Tibia 15 to 17 mm.
                  - Ear 12 to 14 mm .... *lucifugus* (p. 59)
                  - Ear 14 to 16 mm .... *alascensis* (p. 63)

MYOTIS VELIFER (J. A. Allen).

1890. *Vespertilio velifer* J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., III, p. 177, Dec. 10, 1890.

1896. *Vespertilio incautus* J. A. Allen, Bull. Am. Mus. Nat. Hist., N. Y., VIII, p. 239, Nov. 21, 1896. (Texas.)

Type locality.—Santa Cruz del Valle, near Guadalajara, Jalisco, Mexico.

Geographic distribution.—Near border line between upper and lower Sonoran zones from Missouri and Indian Territory south to Hidalgo, northern Michoacan, and the City of Mexico.

General characters.—Largest species of *Myotis* known to occur in Mexico or the United States. Length 90 to 105, forearm 40 to 47. Calcar slender, without well-developed lobe. Free border of uropatagium naked. Ears short, reaching tip of nose. Wings from metatarsus.

Ears.—The ears are short and pointed; laid forward they reach to or just beyond nostril. Auricle concave on both sides immediately below the narrowly rounded off tip (most strongly so on the posterior border). Anterior border straight or very slightly convex through the basal two-thirds of its length, then concave or almost straight to tip; posterior border strongly concave directly below tip, then still more strongly convex to basal notch, the widest part of the ear at about mid height. Basal notch well defined, isolating a prominent basal lobe, which is slightly notched on the lower side and joins the side of the face in a line which if continued would coincide with the margin of the upper lip.

Tragus moderately long and broad, the anterior edge straight or very slightly convex toward the tip; posterior border with a well-developed lobe at base; just above the lobe the tragus attains its greatest width; the two borders are usually parallel for a short distance, after which the posterior border bends rapidly forward to the tip, below which it may be either straight or very slightly concave.

Membranes.—The membranes are, for an American *Myotis*, rather thick and opaque. The uropatagium is sparsely haired both dorsally and ventrally on its proximal fourth; the free border, which is distinctly shorter than the calcar, wholly naked. Wing from point between ankle and base of toes, but nearer the latter. When drawn away perpendicularly from the leg, the wing appears to be attached to the ankle.

Feet.—Feet (Pl. II, fig. 6) large and strong, half as long as tibiæ. Toes (without claws) slightly longer than sole, scarcely united by membrane at extreme base, all sprinkled with long, stiff hairs. Calcar long, slender, usually terminating indistinctly, but sometimes with a more or less well-defined lobule at tip.

Fur and color.—There is nothing peculiar about the distribution of the fur to distinguish this bat from other American members of the genus.

In color the fur is dull sepia throughout, paler on the belly, the hairs everywhere dusky slate at base. Individual variation is trifling and is mostly confined to the belly. This is usually dull broccoli brown, but in some specimens by admixture of yellow it becomes more nearly isabella color.

Skull.—Skull stronger and more heavily built than in any other *Myotis* found in Mexico or the United States, but not actually larger than that of *M. thysanodes.* Greatest length (5 specimens) 16 to 16.4; zygomatic breadth, 10 to 11; interorbital constriction, 4 to 4.2; width of rostrum at anterior root of $\underline{\text{m 1}}$, 6 to 6.2; length of mandible, 12 to 13. When viewed from above, the brain case is subcircular in outline but truncate posteriorly and slightly longer than broad. Forehead moderately elevated above muzzle; occiput high and compressed, with well-developed ridges. Distance from posterior border of last upper molar to tip of hamular equal to or less than distance between alveoli of posterior molars.

Teeth.—Upper incisiors diverging at tips, the inner tooth of each pair much the larger. First and second premolars in the tooth row or second displaced slightly inward and partly concealed by the anterior edge of the third, the relative size of the two teeth variable, but first always the larger. The second premolar is always much shorter than the first, but the cross section of the crown is sometimes nearly equal in the two teeth. On the other hand, in rare cases the area of cross section in the first is nearly double that of the second. Third upper premolar triangular in outline, posterior margin longest, the outer margin abruptly convex anteriorly, the anterior and posterior borders slightly concave; inner apex of triangle bluntly rounded and not reaching to level of inner margins of molars. Crowns of first and second upper molars trapeziform in outline, the anterior edge longest, and the posterior, outer, and inner edges successively shorter. Anterior edge slightly convex, posterior edge slightly concave. Crown of first molar considerably shorter in proportion to its width than second (fig. 14 *d*, p. 61). Inner mandibular incisors smallest, their crowns compressed and trifid; middle incisors similar but larger; outer incisors about as large as the two others together, their crowns irregularly terete, and with four indistinctly developed tubercles, one of which is much larger than the others. First and second premolars perfectly in line, the first considerably larger than the second, though not much wider in cross section. Third premolar as broad as long, trapeziform, the posterior margin longest.

Measurements.—In the following table average measurements are given of 20 specimens of *Myotis velifer* from six localities.

Average measurements of 20 specimens of Myotis velifer from 6 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Michoacan: Patzcuaro	5	99	44.8	18.5	9.5	45	7.2	73.4	16	10.6	9
Hidalgo: Tulancingo	3	97	42	18.3	8.9	43.6	7.2	71.3	16.1	10.3	8.5
Mexico: Ixtapalapa	1♂	94	40	17.6	8.6	42	6.4	71	15.4	11	9
Arizona: San Bernardino Ranch	4	98.8	42	16.5	9	41.5	6.4	69	------	------	7.8
Texas: San Antonio	1[1]	95.2	44.4	18	8.4	43	7	62	------	------	------
San Antonio	4	93.3	41.3	18.1	9.3	43	6.9	67	------	------	------
Missouri: Marble Cave	3	93.6	39.6	17.9	9.8	42.6	7	69.3	15.6	10.1	8.1

[1] Type of *'incautus.'*

Specimens examined.—Total number 46, from the following localities:

Arizona: San Bernardino Ranch (Monument 77, Mex. Bound. Line), 5 (skins).
Hidalgo: Tulancingo, 4 (1 skin).
Indian Territory: Fort Reno, 3.
Jalisco: Guadalajara, 2 (skins, Merriam Coll.); Santa Cruz del Valle, 3 (skins, Am. Mus. Nat. Hist.); Hacienda San Marcos, Tonila, 1 (skin, Am. Mus. Nat. Hist.).
Mexico: Lerma, 1; Ixtapalapa, 1; City of Mexico, 1 (skin).
Michoacan: Patzcuaro, 11 (3 skins).
Missouri: Marble Cave, Stone County, 3.
San Luis Potosi: Ahualulco, 1.
Texas: Mouth of Pecos River, 4; New Braunfels, 1; San Antonio, 4 (skins, Am. Mus. Nat. Hist., including type of '*incautus*').
Vera Cruz: Las Vigas, 1.

General remarks.—Through the kindness of Dr. J. A. Allen, I have been able to examine two of the original specimens of *Myotis velifer* from Santa Cruz del Valle, Guadalajara, Jalisco, and four specimens (including the type) of '*Vespertilio incautus*' from San Antonio, Texas. After comparing the specimens of '*incautus*' with seven *M. velifer* from various parts of Mexico, I can find no characters to separate the two even subspecifically. In size as well as in cranial and dental characters they agree perfectly, while the difference in color is too slight to be described by words. As the specimens from Mexico were all taken in midsummer and those from Texas were killed in October the variation in color is probably seasonal.

The large size of this bat distinguishes it at a glance from all other Mexican or United States species except *M. thysanodes*. From the latter the darker color, slender calcar, naked free border of interfemoral membrane, and shorter ears and tragus separate it without difficulty.

Myotis velifer, while totally different from all other bats found in Mexico or the United States, is doubtfully distinct from the South American *M. albescens*. Mr. Oldfield Thomas, who has compared for me specimens of the former with the *albescens* in the British Museum so named by Dobson after examination of the type, writes that *M. velifer* and *M. albescens* are practically identical. It is best, however, to retain the name *velifer* for the bat occurring in Mexico and the United States until the South American species has been positively identified.

Dr. Harrison Allen refers to this bat in his recent monograph as *Vespertilio albescens velifer*. Under the same name he mentions a specimen of *M. thysanodes* from 'Dalyura' (=Dulzura), Cal.; while the Texan specimens of *velifer* in the Biological Survey collection he has labeled '*V. albescens?*'

MYOTIS LUCIFUGUS (Le Conte). Little Brown Bat.

1831. *Vespertilio lucifugus* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, Append., p. 431. (Southern Georgia.)
1856. *Vespertilio subulatus* Le Conte, Proc. Acad. Nat. Sci. Phila. (1854–55), p. 435.
1864. *Vespertilio affinis* H. Allen, Monogr. N. Am. Bats, p. 53.
1864. *Vespertilio lucifugus* H. Allen, Monogr. N. Am. Bats, p. 55.

1878. *Vespertilio carolii* Dobson, Catal. Chiroptera Brit. Mus., p. 325.
1893. *Vespertilio gryphus* Var. (a) *Vespertilio gryphus lucifugus* H. Allen, Monogr Bats N. Am., p. 78.
1893. *Vespertilio albescens affinis* H. Allen, Monogr. Bats N. Am., p. 93.
1897. *Vespertilio lucifugus austroriparius* Rhoads, Proc. Acad. Nat. Sci. Phila., p. 227, May 1897. (Tarpon Springs, Florida.)

Type locality.—Georgia, probably southern Liberty County.

Geographic distribution.—The whole of North America north of the southern boundary of the United States, except in the Rocky Mountains and on the Pacific coast of California, Oregon, Washington British Columbia, and southern Alaska.

General characters.—Size medium; length 80 to 90; forearm 36 to 40; tibia 14.6 to 16.6. Calcar slender, indistinct, about equal in length to free border of uropatagium, usually terminating in a faintly indicated lobule; keel very slightly developed, if at all. Free border of uropatagium naked. Ears short, laid forward they reach about to nostril.

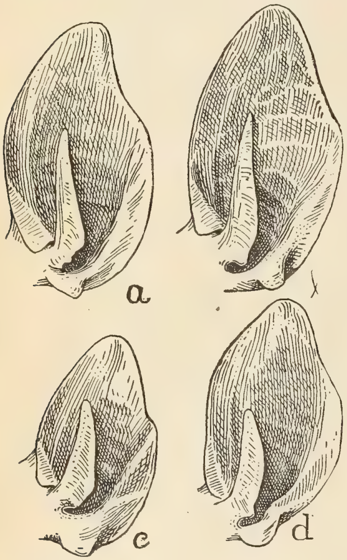


Fig. 13.—Ear of (*a*) *Myotis subulatus*, (*b*) *M. keenii*, (*c*) *M. lucifugus*, and (*d*) *M. alascensis* (×2).

Ears.—The ears (fig. 13, *c*) are short and pointed, reaching when laid forward barely to tip of nose. The anterior border is straight from base through lower third, then for a short distance strongly convex, and finally straight to narrowly rounded off tip. Posterior border gently concave from just below tip to about middle, where it becomes convex and continues so to basal notch. Basal notch moderately developed, isolating a broad but not conspicuous basal lobe.

Tragus short, blunt, bent slightly forward. Anterior border straight or slightly concave from base to tip. Posterior border straight or slightly convex immediately below tip, then more strongly convex to notch above large and prominent basal lobe. Greatest width of tragus through basal lobe or at about middle height, according to convexity of posterior border.

Membranes.—Membranes rather thick and leathery, entirely naked except where fur of body extends in a narrow line at the base of the wings and uropatagium. On the latter the fur occupies about the basal fourth on the dorsal side, rather less ventrally. The wings are attached at the base of the toes.

Feet.—The feet are large and strong, slightly more than half length of tibiæ. Toes longer than sole, joined by membrane at base to a point slightly beyond middle of proximal phalanges. The membrane extends farther on first digit than on fifth.

Fur and color.—The distribution of the fur in *Myotis lucifugus* is in no way peculiar. The hairs are everywhere dusky slate at base. General color dull brown with a distinct gloss in certain lights, the ventral surface paler and more yellowish. The exact shades are variable. Thus in three specimens taken at Washington, D. C., in June, the color of the back is respectively wood brown, raw umber, and sepia, the belly in each pale wood brown tinged to a varying degree with gray. In the majority of individuals the color tends toward sepia. Seven skins from Elk River, Minn., and three from Kadiak Island, Alaska, are indistinguishable in color from those taken at Washington. Ears and membranes light brown.

Skull.—The skull of *Myotis lucifugus* is characterized by the broad muzzle and palate and gradually sloping forehead. In most specimens the face line begins to rise almost from the tip of the muzzle; in others, however, there is a short flat area back of the nasal opening. The brain case is broad and inflated at the back, less so in front, producing in many individuals a wedge-shaped outline. Distance from posterior molar to tip of hamular less than distance between posterior molars.

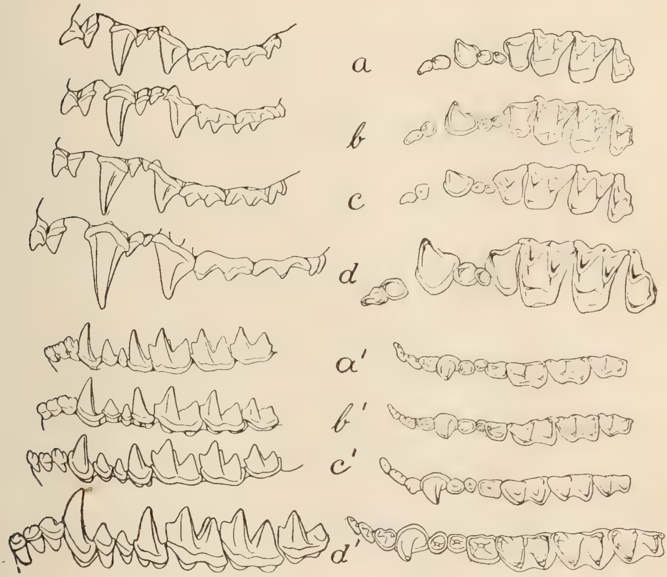


Fig. 14.—Teeth of (*a*) *Myotis yumanensis*, (*b*) *M. lucifugus*, (*c*) *M. lucifugus longicrus*, and (*d*) *M. velifer* (× 5).

The skull of *Myotis lucifugus* differs from that of *M. subulatus* in its slightly smaller size, broader palate and muzzle, and less abruptly elevated face line.

Teeth.—Upper incisors diverging at tips (fig. 14 *b*). Crown of first bicuspidate, and, when viewed from below, nearly rectangular and about twice as long as broad. Larger cusp placed at extreme anterior end; the smaller one on the inner edge near posterior border. Crown of second incisor subterete, unicuspidate. Crown of first premolar longer than second when viewed from the side, slightly larger, or in rare cases very much larger than the latter in cross section; the two teeth in line, or second slightly displaced inward. There is nothing characteristic in the form of the third premolar or of the molars. Maxillary incisors as usual in the genus, the middle pair and the next compressed and trifid, the outer much larger and subterete. First maxillary premolar with crown longer than the second when viewed from the side, and one-fourth to one-third larger in cross section; the two teeth perfectly in line, or second slightly displaced inward. Third premolar subquadrate, nearly as broad as long. The lower molars show no distinctive characters.

As compared with *M. subulatus*, the species with which it is most likely to be confused, *Myotis lucifugus* shows numerous differences in dental characters. The tooth row, as a whole, is shorter, and the individual teeth relatively smaller. The first and second premolars in each jaw are actually smaller, and in most specimens more nearly equal in size in cross section. In *M. subulatus* the premolars are so large that the second is often crowded inward from the tooth row, a condition rarely seen in *M. lucifugus*. The form of the third lower premolar is very different in the two species. When viewed from the side, this tooth is conspicuously broader in proportion to its heigh in *M. subulatus*. When viewed from above, the tooth is much larger in *M. subulatus*, and distinctly longer than broad, while in *M. lucifugus* it is nearly as broad as long.

Measurements.—See table, page 65.

Specimens examined.—Total number 562, from the following localities:

Alabama: Greensboro, 1 (skin, Merriam coll.).
Alaska: Kadiak Island, 9.
Connecticut: 1 (Merriam coll.).
District of Columbia: Washington, 20 (majority in Merriam coll.).
Florida: Tarpon Springs, 7 (two skins, Rhoads coll., type and topotypes of '*austroriparius*').
Illinois: Warsaw, 141; West Northfield, 2.
Kentucky: Mammoth Cave, 218.
Maine: Eastport, 1.
Maryland: Seneca River, 1.
Massachusetts: Woods Hole, 1.
Minnesota: Elk River, 7; Fort Snelling, 4.
Newfoundland: Bay St. George, 4 (skins, Bangs coll.).
New York: Adirondacks, 1 (Merriam coll.); Big Moose Lake, 1 (Merriam coll.); Catskill Mountains, 2; Howes Cave, 25 (Merriam coll.); Lake George, 1; Locust Grove, 9 (Merriam coll.); Lyons Falls, 4 (Merriam coll.); Oneida Lake, 63 (Miller coll.); Peterboro, 1 (Merriam coll.); Sing Sing, 1 (Merriam coll.); West Point, 1.
North Carolina: Roan Mountain, 1.
Nova Scotia: Halifax, 1.

Ontario: Gravenhurst, 1 (Miller coll.); James Bay, 2; North Bay, Lake Nipissing, 1 (Miller coll.).
Pennsylvania: Bradford, 1; Center County, 19.
Quebec: Godbout, 4 (Merriam coll.); Ottawa, 2 (Merriam coll.).
South Carolina: Beaufort, 3.
Virginia: Riverton, 1.

General remarks.—*Myotis lucifugus* resembles *M. velifer* more closely than it does any other North American species. From the latter it is, however, readily distinguishable by its much smaller size. From *M. subulatus*, the only species of the genus with which it is associated in the eastern United States, it may be at once recognized by its shorter ear and shorter, less acuminate tragus.

This bat is the *Vespertilio gryphus lucifugus* of Dr. Harrison Allen's recent monograph. Dr. Allen's 'northern form of *Vespertilio gryphus*' is *M. subulatus*.

Through the kindness of Mr. S. N. Rhoads I have examined the type and six topotypes of *Vespertilio lucifugus austroriparius* from Tarpon Springs, Fla. I can find no characters by which these specimens may be distinguished from those taken at other parts of the range of *Myotis lucifugus*. The two skins, one of which is the type, are those of partly grown individuals whose immaturity is clearly indicated by the soft, papery skulls in which the nasal sutures are still clearly visible, and by the imperfectly formed joints of the fingers (see fig. 1, p. 9). These specimens differ from northern adults in smaller size, shorter fur, and duller, browner color. Three adult topotypes in alcohol show only one of these peculiarities—the shortness of fur—and in the fourth this also is absent. The fifth alcoholic specimen is immature. That the adult specimens of *Myotis* from Tarpon Springs are not smaller than *M. lucifugus* from other localities is clearly shown by the table of measurements on page 65. The short fur of three of the adults is evidently a seasonal character, since all showing this peculiarity are in worn, ragged coat, while the only one in fresh pelage (killed September 12) has fur of the ordinary length. The fur of all these specimens, after nearly five years immersion in alcohol, has lost the warm, glossy appearance characteristic of freshly killed individuals. It can be perfectly matched, however, among the series of alcoholic specimens collected in Center County, Pa., during the winter of 1893.

MYOTIS LUCIFUGUS ALASCENSIS subsp. nov.

Type from Sitka, Alaska. Adult ♀ (in alcohol), No. 77416, U. S. National Museum (Biological Survey collection). Collected August 5, 1895, by C. P. Streator. Collector's number, 4754.

Geographic distribution.—Humid coast district of southern Alaska and northern British Columbia.

General characters.—More like typical *lucifugus* than like *longicrus*, but darker in color and with longer ears.

Ears.—As shown in the table of measurements on page 65 the ears of this form average distinctly larger than those of the typical subspecies. I can not see, however, that they differ appreciably in form (fig. 13*d*).

Fur and color.—The fur is distributed as in true *lucifugus*. In color it is evidently darker than that of the typical form, but the exact differences can not be determined from specimens in alcohol. Ears and membranes blackish.

Measurements.—See table, page 65.

Specimens examined.—Total number 16, from the following localities:

Alaska: Fort Wrangel, 1 (skin, Merriam coll.); Loring, 4 (1 skin); Sitka, 8 (3 skins).

British Columbia: Massett, Queen Charlotte Islands, 3.

General remarks.—*Myotis lucifugus alascensis* is distinguishable from both typical *M. lucifugus* and *M. lucifugus longicrus* by its longer ears and darker color. From *M. lucifugus longicrus* it differs further in its much shorter tibia.

MYOTIS LUCIFUGUS LONGICRUS (True).

1886. *Vespertilio longicrus* True, Science, VIII, p. 588, Dec. 24, 1886.
1893. *Vespertilio nitidus longicrus* H. Allen, Monogr. Bats N. Am., p. 103.
1893. *Vespertilio albescens* (melanic phase) H. Allen, Monogr. Bats N. Am., p. 92 (part).

Type locality.—Puget Sound.

Geographic distribution.—Boreal and Transition zones from Puget Sound east to Wyoming; south at least to Arizona and southern California, and probably much farther.

General characters.—Similar to typical *Myotis lucifugus*, but larger (length, 94 to 102; forearm, 37 to 40; tibia, 17.8 to 19), and with longer tibia and proportionally shorter ear and forearm.

Ears.—The ears are more rounded and proportionally slightly shorter than in typical *M. lucifugus*, the inner side of the conch usually more hairy. Tragus as in *M. lucifugus*.

The membranes and feet differ in no way from those of the true *M. lucifugus*, except that the feet appear shorter in proportion to the tibiæ.

Fur and color.—The fur shows no peculiarities in distribution. In color it is darker and duller than in the typical subspecies (especially in specimens from northern California), but the difference is apparently never very striking, while two skins from Arizona are indistinguishable from specimens of *lucifugus* taken at Washington, D. C.

Skull.—The skull of *Myotis lucifugus longicrus* does not differ appreciably in size or form from that of true *lucifugus*.

Teeth.—In dental characters *Myotis lucifugus longicrus* agrees closely with typical *M. lucifugus*. While there appear to be no constant and important differences between the teeth of the two forms, the third upper premolar averages slightly larger in *longicrus*, and there are usually trifling differences in the relative sizes of the lower premolars (fig. 14*c*).

Measurements.—See table, on page 65.

Specimens examined.—Total number 97, from the following localities:

Arizona: San Francisco Mt., 2; Chiricahua Mts., 1 (skin).
California: Nevada City, 4; Nicasio, 72; Owens Lake, 1; Point Reyes, 1; San Emigdio, 1; Walker Pass, 2.
Chihuahua: San Francisco Water Canyon, San Luis Mts., 1.
Colorado: Grand Junction, 1.
Nevada: Cottonwood Range, 1 (skin); Panaca, 1.
New Mexico: Santa Fe, 1.
Oregon: East base Cascade Mts., near Mt. Thielson, 1 (skin); Beaverton, 2 (Miller Coll.).
Washington: Cape Flattery, 1; Colville, 1; Geyser Basin, 1; Port Townsend, 1.
Wyoming: Lake Fork, 1.

General remarks.—*Myotis lucifugus longicrus* is a well-marked geographical race of *M. lucifugus*, replacing the typical form of the latter in the western United States throughout the region west of the Great Plains. The northern and southern limits of its range can not at present be determined.

A single skin from Cofre de Perote, Vera Cruz, is probably referable to *M. lucifugus longicrus*. The tibia, however, is slightly shorter than in true *longicrus*, and more material from southern localities may show the necessity of recognizing another geographic race.

Myotis lucifugus longicrus is the bat to which the 'melanic form of *Vespertilio albescens*' of Dr. Allen's recent monograph for the most part refers. Under this name, however, Dr. Allen also included dark-colored specimens of *M. californicus*.

Measurements of subspecies of Myotis lucifugus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
lucifugus	Florida: Tarpon Springs	4	89.5	40	16	8.7	38.8	6.2	63.7	13.7	9.4	7.1
	District of Columbia: Washington.	2♀♀	86.5	37.5	....	9	38.9	6.7	....	12.2	9.4	7.5
	Pennsylvania: Centre County	6	85.3	37.6	15.5	7.3	37.6	5.6	60.2	13.3	9.7	7.2
	New York: Howes Cave	10	86.3	38.4	16.5	8.7	38	6.6	61.5	13.2	9.1	8
	Newfoundland: Bay St. George	4♀♀	87.7	37.2	15.5	9	36.7	6.1	61.2	....	....	....
alascensis	Alaska: Kadiak Island	6	88.6	38.3	16.1	9.1	36.1	....	....	13.6	8.5	7
	Sitka	1♀[1]	91	39	16	9	38	6.4	60	16	10.6	8
	Sitka	8♀♀	86.3	38.6	16	8.4	36.6	6.2	59	15.2	9.5	7.6
	Loring	3	80	35	15	8	34.6	6.2	57.6	14.8	8.9	7
longicrus	British Columbia: Massett	3	85.6	37.6	16.9	8.9	37	6.2	60	14.9	9.9	7
	Washington: Puget Sound	1♀	97	44	19	8	38.5	6	65	12	10	7
	California: Nicasio	10	95.3	43.6	18.7	7.7	37.6	5.5	65.3	12	9.8	7.3
	Nevada City	1♀	102	46	19.6	8	39.6	6	71	13	9.8	7.4
	Owens Lake	1♀	96	45	17.8	8.4	....	6	69	12.6	9	7.4
	Walker Pass	2♀♀	97	44.6	18.5	7.4	39.6	6	69	12.6	10	7.4
	San Emigdio	1♀	100	45	18.8	7.6	40	5	69	13.4	9.6	7.4
	Wyoming: Lake Fork	1♂	97	45	19	8	38	7	71	12.6	9	7.4
	Nevada: Panaca	1♂	94	43	18.4	8	39.6	5.6	68	12	9	7.4
	Arizona: San Francisco Mountain	2	93.5	41	17.3	7.7	38.5	6.2	68	13.5	9.5	8.2

[1] Type.

MYOTIS YUMANENSIS (H. Allen).

1864. *Vespertilio yumanensis* H. Allen, Monogr. N. Am. Bats, p. 58.
1866. *Vespertilio macropus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 288, (nec Gould, 1854).
1893. *Vespertilio nitidus* (pedomorphic variety) H. Allen, Monogr. Bats N. Am., pp. 72, 73.
1893. *Vespertilio albescens* H. Allen, Monogr. Bats N. Am., p. 87, (part, nec Geoff., 1805).
1893. *Vespertilio nitidus macropus* H. Allen, Monogr. Bats N. Am., p. 100.

Type locality.—Old Fort Yuma, California.

Geographic distribution.—Austral zones and lower edge of Transition zone from the southwestern United States to San Luis Potosi and Michoacan, Mexico.

General characters.—Size small; length 74–88; forearm 32–37; calcar distinct, considerably longer than free border of interfemoral membrane, terminating in a well-marked lobule; free border of uropatagium naked; ears moderate; wings from base of toes, but on account of extent of web between toes apparently from side of metatarsus; feet very large and strong as compared with other small American species.

Ears.—The ears (Pl. I, fig. 2) are moderately long; laid forward they reach just beyond the tip of the nose. The anterior border is straight for a short distance at base, then strongly convex, and finally straight or even slightly concave just below tip. The tip is narrow and abruptly rounded off. The posterior border is concave from the tip to the widest part of the auricle, just below mid height, then strongly convex to basal notch, which isolates a well-marked rounded lobe.

Tragus slender, acutely pointed. Anterior border slightly concave at base, then straight or very faintly concave to tip. Posterior border crenulate, straight or slightly concave from tip to broadest point at about lower third. A very large lobe at base; this lobe so large that the greatest breadth of the tragus is often through it.

Membranes.—The membranes, especially the uropatagium, are, for so small a bat, thick and leathery. The interfemoral membrane (Pl. II, fig. 2) is furred at the base, both dorsally and ventrally, but otherwise is naked except for a sprinkling of short hairs along the veins. Wings from base of toes, but on account of the conspicuous webbing of the latter the membrane appears to be attached to the side of the metatarsus.

Feet.—The feet (Pl. II, fig. 2) are, for so small a bat, very large, broad, and strong, more than half as long as the short tibiæ, the whole leg and foot suggesting a small *Nycticeius* rather than a *Myotis*. Toes (without claws) as long as sole, united by membrane at base to distal fourth of proximal phalanges. Calcar strong and distinct, much longer than free border of uropatagium, usually terminating in a distinct lobule. Keel on posterior edge very slightly developed.

Fur and color.—The fur shows no peculiarities in distribution. On the middle of the back it averages about 6 mm. in length.

Color pale wood brown, varying to broccoli brown; belly dirty whitish; the fur everywhere light plumbeous at base; ears and membrane very light brown; the uropatagium and wing membranes edged with whitish.

Specimens from the type locality are the palest that I have seen. Those from Fort Verde, Arizona, and apparently also alcoholic specimens from Tulare and other localities in southern California, are slightly darker, but still very different from *M. yumanensis saturatus.*

Skull.—The skull of *Myotis yumanensis* resembles that of *M. lucifugus* in form, but is distinguished from the latter by its smaller size, and shorter, broader palate. The brain case is broader and flatter than in *M. lucifugus.* From the skull of *M. californicus* that of *M. yumanensis* is readily distinguished by its slightly larger size and very much broader, more robust form, the rostrum in particular being noticeably broader.

Teeth.—The teeth of *Myotis yumanensis* (fig. 14 *a*) more closely resemble those of *M. lucifugus* than any other species. They are, however, smaller, and the crowns of the molars are longer in proportion to their width. The crown of the third lower premolar is only slightly longer than broad, thus resembling the corresponding tooth in *M. lucifugus*, and differing from *M. californicus*, which, like *M. subulatus*, has the crown of this tooth very distinctly longer than broad.

Measurements.—See table, page 69.

Specimens examined.—Total number 142, from the following localities:

Arizona: Fort Verde, 6 (skins); White Mountains, 1 (skin, Am. Mus. Nat. Hist.).
California: Fort Reading, 1; Fort Yuma, 5 (skins); Fresno, 8; Horse Shoe Bend, Colorado River, 1; Keeler, 7; Lone Pine, 2; Mount Whitney, 1; Nevada City, 2; Nicasio, 1; Owens Lake, 5; Owens Valley, 1; Old Fort Tejon, 13; San Luis Rey, 8; Tulare, 45; Walker Pass, Kern County, 1.
Michoacan: Patzcuaro, 13.
Nevada: Pyramid Lake, 1.
San Luis Potosi: Jesus Maria, 7; Hda. La Parada, 3; Ahualulco, 9.
Utah: Provo City, 1.

General remarks.—Myotis yumanensis needs comparison with *M. californicus* only. From the latter it is readily distinguished by its much larger foot and longer calcar. More detailed comparison of the two will be found under *M. californicus.*

This is the species to which Dr. Harrison Allen's recent account of *Vespertilio albescens* for the most part refers. His so-called larger melanic form of *albescens* is *Myotis lucifugus longicrus* (True). Specimens of *Myotis californicus*, *M. thysanodes*, and *M. velifer* in the Biological Survey collection have been labeled by Dr. Allen *V. albescens*, the last two, however, with a query. This bat is also the *Vespertilio macropus* and *V. nitidus macropus* of Dr. Allen. The name *macropus*, however, is preoccupied by *Vespertilio macropus* Gould, 1854.[1]

Myotis yumanensis is a much smaller bat than *M. albescens*, and does not agree with the descriptions of the latter given by Geoffroy or Dobson. Mr. Oldfield Thomas, after comparing specimens of *M. yumanensis* with the *M. albescens* identified by Dobson in the British Museum, writes me that the two are in no way closely related.

---

[1] Mammals of Australia (*fide* Dobson).

Lack of an adequate series of skins prevents any determination of the extent of individual color variation in this species. Specimens taken at Fort Verde, Arizona, in May and August, are slightly darker than those killed at the type locality in April, while two July skins from Patzcuaro, Michoacan, are nearly as dark as the lightest examples of *M. yumanensis saturatus.*

MYOTIS YUMANENSIS SATURATUS subsp. nov.

Type from Hamilton, Washington. Adult ♂ (skin), No. $\frac{17399}{24306}$, U. S. National Museum (Biological Survey collection). Collected September 13, 1889, by T. S. Palmer. Collector's number, 392.

Geographic distribution.—Transition zone in Oregon, Washington, and British Columbia.

General characters.—Similar to typical *Myotis yumanensis*, but fur longer and color much darker.

Fur and color.—Fur distributed as in the typical subspecies. On the middle of the back it averages about 9 mm. in length. Back dark glossy yellowish brown (the exact shade usually between the 'sepia' and 'mummy brown' of Ridgway's Nomenclature of Colors, Pl. III); belly isabella color; chin, throat, and sides darker than belly; fur everywhere deep blackish plumbeous at base; ears and membranes blackish.

Measurements.—See table, page 69.

Specimens examined.—Total number 19, from the following localities:

British Columbia: Kamloops, 1 (skin); Kultus Lake (near Chilliwack), 1 (skin, Miller coll.); Mount Lehman, 1 (skin, Am. Mus. Nat. Hist.); Port Moody, 1 (skin); Shuswap, 1 (skin); Sumas, 3 (skins, Miller coll.).

Oregon: Crooked River, 1[1]; Lone Rock, 2[1]; Twelve Mile Creek, 1[1].

Washington: Chelan, 3[1]; Hamilton, 2 (skins); Lake Cushman, 1 (skin); Neah Bay, 1.

General remarks.—*Myotis yumanensis saturatus* is readily distinguishable from true *yumanensis* by its much darker color. In this character, however, it closely approaches the typical form of *M. lucifugus*, from which it differs chiefly in smaller general size and much smaller skull. From *M. lucifugus longicrus* it differs very noticeably in its shorter tibia as well as in other characters.

---

[1] These specimens may be nearer true *yumanensis* than *saturatus*. In alcohol, however, their color appears much too dark for the typical subspecies.

Measurements of subspecies of Myotis yumanensis.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
yumanensis	California: Fort Yuma	4	83.7	35.5	14.1	8.7	32.7	5.2	56.5	....	....	....
	Tulare	10	80.5	36.6	15	8.7	34.2	6	56.4	14.2	9	7.4
	Arizona: Fort Verde	4	79.2	36.7	15.7	8.8	33.9	....	55.5	14	8.2	7
	San Luis Potosi: Jesus Maria	5♀♀	81	34.9	15.5	7.9	34.4	6.5	57.8	14.4	9.1	7.6
	Michoacan: Patzcuaro	8	80.6	36.3	14.6	8.3	34.1	5.7	57	14.2	9	7.6
saturatus	British Columbia: Sumas	3	82.3	36.5	14	8.6	34.6	5.3	57	....	....	....
	Washington: Chelan	3	77	35	15	8.3	35.3	6	59.3	14.3	8.9	7
	Hamilton	1♂[1]	77	30	15	8.6	33	5	...	....	....	....

[1] Type.

MYOTIS CALIFORNICUS (Aud. & Bach.).

1842. *Vespertilio californicus* Aud. & Bach., Journ. Acad. Nat. Sci. Phila., p. 280 (California).
1862. *Vespertilio nitidus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 247 (Monterey, California).
1864. *Vespertilio nitidus* H. Allen, Monogr. N. Am. Bats, p. 60.
1864. *Vespertilio oregonensis* H. Allen, Monogr. N. Am. Bats, p. 61 (Cape St. Lucas and Fort Tejon).
1866. *Vespertilio obscurus* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 281 (Lower California).
1866. *Vespertilio volans* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 282 (Cape St. Lucas).
1866. *Vespertilio exilis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283 (Cape St. Lucas).
1866. *Vespertilio tenuidorsalis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283 (Cape St. Lucas).
1866. *Vespertilio yumanensis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 283 (nec H. Allen, 1864).
1878. *Vespertilio nitidus* Dobson, Catal. Chiroptera Brit. Mus., p. 318.
1890. *Vespertilio melanorhinus* Merriam, North American Fauna, No. 3, p. 46, Sept. 11, 1890 (San Francisco Mt., Arizona).
1893. *Vespertilio albescens melanorhinus* H. Allen, Monogr. Bats N. Am., p. 91.
1893. *Vespertilio nitidus* H. Allen, Monogr. Bats N. Am., p. 94.
1893. *Vespertilio nitidus henshawi* H. Allen, Monogr. Bats N. Am., p. 103 (Wingate, N. Mexico).
1893. *Vespertilio nigricans* H. Allen, Monogr. Bats N. Am., p. 97 footnote (nec Maximilian 1826).

Type locality—'California.'

Geographic distribution.—Austral zones and lower part of Transition zone throughout the western United States and Lower California, east to Wyoming and Texas. South limit of range not known.

General characters.—Smallest species of *Myotis* known to occur in the United States. Length, 76 to 87; forearm, 30 to 36. Calcar about as long as free border of uropatagium, very slender but distinct and with a more or less well developed lobule at tip, outer edge with a distinct keel. Legs slender, the small feet reaching when extended backward to within about 5 mm. of tip of tail. Free border of uropatagium naked.

Ears moderate, reaching just beyond tip of nose. Wings from base of toes. Fur on back distinctly darker at base than at tip.

Ears.—The ears are moderately long (Pl. I, fig. 2), reaching when laid forward 1 to 3 mm. beyond tip of nose. The anterior border of the auricle is straight or slightly convex at the base, then strongly convex to a point somewhat beyond the middle, after which it is straight or even a little concave to the narrowly rounded off tip. Posterior border concave from tip to point slightly below the middle, after which it is convex to basal notch. Basal lobe strongly developed and notched on its lower border.

Tragus varying much in shape, but with anterior border usually straight, or nearly so, and posterior border strongly convex and with small basal lobe.

Membranes.—The membranes are thin and delicate. Uropatagium (Pl. II, fig. 1) furred on basal third, otherwise naked, except for a few hairs along the veins. Wings from base of toes, naked, except for a narrow strip along side of body.

Feet.—The feet are small and weak (Pl. II, fig. 1), distinctly less than half as long as tibia. Calcar slender but distinct, shorter than free border of uropatagium, usually terminating in a distinct lobule. The posterior border is provided with a keel beginning abruptly about 2 mm. from the base and fading away gradually at about middle of calcar. This keel is supported by 1 to 3 cartilaginous outgrowths from the calcar.

Fur and color.—The fur is soft, full, and long, that on middle of back averaging about 8 mm. in length.

Color light yellowish gray, paler on the belly, the fur everywhere dark plumbeous at base. Membranes, ears, lips, and muzzle blackish.

Skull.—The skull of *Myotis californicus* is smaller and more lightly built than that of any other North American *Myotis*. The brain case is moderately rounded, and the long narrow muzzle fades gradually into the gently sloping forehead. The skull is thus very different from that of *M. yumanensis*, the only species with which *M. californicus* is likely to be confused. In form it resembles the skulls of *M. evotis* and *M. thysanodes*, but the latter are among the largest of the species found in the region inhabited by *M. californicus*.

Teeth.—The teeth of *Myotis californicus* (fig. 15, *a*) are, like the skull, small and delicate. In general they closely resemble the teeth of *M. subulatus*, and differ from those of *M. yumanensis* in numerous details, as in the shape of the third upper molar and third lower premolar, the former being distinctly narrower and the latter longer in proportion to its width than in *M. yumanensis*.

Measurements.—See table, page 74.

Specimens examined.—Total number 152, from the following localities:

Arizona: Camp Grant, 2; Oracle, 5; Prescott, 1 (skin, Am. Mus. Nat. Hist.); Santa Catalina Mountains, 1 (skin); Tinajas Altas, Yuma County, 3; White Mountains, 1 (skin, Am. Mus. Nat. Hist.).

California: Amargosa River, Mohave Desert, 1; Banning, 1; Cahto, 1; Colorado Desert, 1; Death Valley, 14 (including Bennett Wells, 1; Funeral Mountains, 1; Saratoga Springs, 6); Dulzura, 15 (6 skins, Miller coll.); East Fork Kaweah River, 3; Fort Crook, 1; Fort Tejon, 11; Old Fort Yuma, 1; Jacumba, San Diego County, 1; Kern River (25 miles above Kernville), 1; Monterey, 1; Mount Shasta, 1; Nicasio, 7; Petaluma, 1; Point Reyes, 5; San Clemente Island, 3; Santa Barbara, 1; Santa Ysabel, San Diego County, 23; Tejon Pass, 1; Tres Pinos, 1; Twin Oaks, San Diego County, 1; Witch Creek, San Diego County, 7.

Chihuahua: East side of San Luis Mountains, 3.

Lower California: Cape St. Lucas, 2 ('*V. obscurus*' H. Allen); San Fernando, 3 (Miller coll.).

Nevada: Colorado River, 2; Cottonwood Range, 4; Gold Mountain, Esmeralda County, 2; Pahrump Valley, 1; Panaca, Lincoln County, 1; Vegas Valley, Lincoln County, 1.

New Mexico: Fort Defiance, 1; Fort Wingate, 2; Silver City 1 (skin).

Oregon: Elgin, 1; John Day River, 3; Twelve Mile Creek, 2.

Texas: Paisano, 1.

Washington: Almota, Whitman County, 1; Blue Creek, 1; Chelan, 1.

Wyoming: Bitter Creek, Sweetwater County, 2 (skins, Am. Mus. Nat. Hist.); Bull Lake, 1.

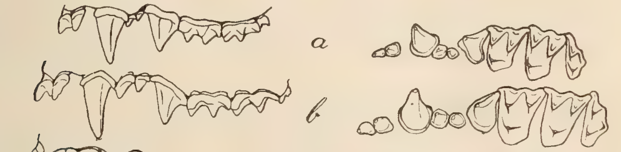


FIG. 15.—Teeth of (*a*) *Myotis californicus*, (*b*) *M. subulatus*, (*c*) *M. evotis*, and (*d*) *M. thysanodes* (× 5.)

General remarks.—Typical *Myotis californicus* varies considerably in color, size, and proportions, but may always be recognized among North American and Mexican species by its small size, slender form, delicate membranes, long tail and legs, small feet, and pale yellowish color. *Myotis yumanensis*, the only other species of equally small size, has conspicuously shorter legs, larger feet, shorter tail, and thicker membranes. The species resembling *M. californicus* in form are all conspicuously larger.

In his recent monograph Dr. Harrison Allen uses the name *Vespertilio nitidus* for *Myotis californicus.* As subspecies of *californicus* he includes *M. yumanensis* (=‘*Vespertilio nitidus macropus*’), *M. californicus ciliolabrum*, and *M. lucifugus longicrus* (=‘*Vespertilio nitidus longicrus*’). *Vespertilio melanorhinus*, a synonym of *M. californicus*, he, however, refers to ‘*V. albescens*’ (=*M. yumanensis*) as a subspecies, ‘*Vespertilio albescens melanorhinus.*’

MYOTIS CALIFORNICUS CAURINUS subsp. nov.

Type from Massett, Queen Charlotte Islands, British Columbia. Adult, ♂ (in alcohol), No. 72219, U. S. National Museum (Biological Survey collection). Collected in 1895 by J. H. Keen.

Geographic distribution.—The humid coast district of British Columbia, Washington, and Oregon (possibly also of northern California).

General characters.—Similar to typical *M. californicus*, but very much darker in color.

Ears, membranes, feet, and fur.—As in typical *californicus.*

Color.—Very deep, frequently almost blackish sepia throughout, slightly yellowish on belly, the fur everywhere blackish plumbeous at base.

Measurements.—See table, page 74.

Specimens examined.—Total number, 14, from the following localities:

British Columbia: Port Moody, 1; Massett, 9.
Oregon: Marmot, 1 (skin).
Washington: Fort Steilacoom, 1; Puget Sound, 1; Tenino, 1.

General remarks.—In color *Myotis californicus caurinus* closely resembles dark specimens of *M. californicus mexicanus.* It is readily distinguishable from the latter, however, by its much smaller size.

MYOTIS CALIFORNICUS CILIOLABRUM (Merriam).

1886. *Vespertilio ciliolabrum* Merriam, Proc. Biol. Soc. Washington, IV, p. 1.
1893. *Vespertilio nitidus ciliolabrum* H. Allen, Monogr. Bats N. Am., p. 101 (part).

Type locality.—Trego County, Kansas.

Geographic distribution.—Trego County, Kansas, and central South Dakota. Limits of range wholly unknown.

General remarks.—Similar to typical *M. californicus*, but very much paler in color.

Ears.—In form the ears of *Myotis californicus ciliolabrum* are as in typical *M. californicus.* They average, however, slightly larger.

Membranes.—The membranes are thin and translucent. Wings from base of toes, and entirely naked except a narrow line close to the body. Uropatagium thinly haired on proximal fifth ventrally and on proximal half dorsally, otherwise naked, but with a few hairs along the veins.

Feet.—The feet are moderately large, about half the length of the tibia, the toes longer than the sole. A distinct wart at heel. Calcar slender, distinct, about equal to free border of interfemoral membrane, terminating in a small but distinct lobule and noticeably keeled along posterior edge. The keel is supported by 1 to 3 cartilaginous processes.

Fur and color.—Except for its unusual extension on the back of the uropatagium the fur shows no peculiarities in distribution.

In color the fur is pale yellowish white throughout. The ears, muzzle, and chin are dark brown in strong contrast. Membranes light brown with pale edges.

Measurements.—See table, page 74.

Specimens examined.—Total number 13, from the following localities:

Kansas: Trego County, 6.
South Dakota: Carroll Draw, Pine Ridge Indian Reservation, 7 (skins Am. Mus. Nat. Hist.).

General remarks.—*Myotis californicus ciliolabrum* is a pale, whitish, race of *M. californicus*, presenting the opposite extreme from *M. c. caurinus.* Except in color, I can not find that it differs in any constant characters from typical *californicus.* The specimens from Grant County, N. Mex., referred to in the original description of *M. c. ciliolabrum* are undoubtedly true *californicus*, as are those from Death Valley referred to this subspecies by Dr. Harrison Allen.

MYOTIS CALIFORNICUS MEXICANUS (Saussure).

1860. *Vespertilio mexicanus* Saussure, Revue et Mag. de Zool., 2e ser., XII, p. 282.
1866. *Vespertilio agilis* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 282 (Mirador, Mex.).

Type locality.—Unknown, but probably Vera Cruz, Puebla, or Oaxaca.

Geographic distribution.—Austral and Transition zones in central and southern Mexico (San Luis Potosi, Michoacan, and Oaxaca). Limits of range not known.

General characters.—Slightly larger than typical *Myotis californicus*, and averaging somewhat darker and yellower in color.

Ears, membranes, feet, and fur.—As in typical *californicus.*

Color.—Dull yellowish brown, slightly paler on the belly. Membranes and ears in dry skins blackish. Two immature specimens from Reyes, Oaxaca, are considerably darker than any of the adults, but otherwise a series of thirteen skins shows very little individual variation.

Skull and teeth.—As in typical *californicus.*

Measurements.—See table, page 74.

Specimens examined.—Total number 51, from the following localities:

Michoacan: Patzcuaro, 44 (8 skins).
Oaxaca: Cuicatlan, 1; Reyes, 5 (skins).
San Luis Potosi: Hacienda La Parada, 1.

Average measurements of subspecies of Myotis californicus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
californicus	California: Saratoga Springs	5♂♂	80	39	14.2	5.4	31.3	4	58	14.2	9.9	8
	Death Valley	5	77.8	38.8	13.9	5.7	31	4.1	55.4	12.9	9.9	8.3
	Arizona: Oracle	5♀♀	82	39	14.4	6	32	4.2	57	14	10	7.5
caurinus	British Columbia: Massett	1♂[1]	75	34	14	7	32	5	54	12.8	8	7
	Massett	9	77	34.5	13.8	6.1	32.1	4.3	54.1	13.2	9.5	7.1
ciliolabrum	Kansas: Trego County	1♀[1]	75	34	15	7	33	6	59	14	9	8.8
	Trego County	5	80.2	36.7	14.6	6.8	32.8	5.4	57	14.6	10	8.5
mexicanus	Michoacan: Patzcuaro	10	81.5	38.[illegible]	14.2	5.9	34.1	4.4	60	14	9.6	7.2

[1] Type.

MYOTIS NIGRICANS (Maximilian).

1826. *Vespertilio nigricans* "Schinz, Thierreich u. s. w., B. I, p. 179" Maximilian, Beiträge zur Naturgesch. v. Brasilien, II, p. 266.
1878. *Vespertilio nigricans* Dobson, Catal. Chiroptera Brit. Mus., p. 319.
1893. *Vespertilio nigricans* H. Allen, Monogr. Bats N. Am., p. 96.

Type locality.—Fazenda de Aga, near the Iritiba River, southeastern Brazil.

Geographic distribution.—Tropical America, north to extreme southern Mexico (Chiapas). Limits of range not known.

General characters.—About the size of typical *Myotis californicus*, but with slightly larger foot and smaller ears; fur on back not distinctly darker at base than at tip.

Ears.—The ears are slightly smaller than in *M. californicus*, but not different in form.

Membranes.—As in *M. californicus.*

Feet.—The feet are relatively larger than in *M. californicus*, but smaller than in *M. yumanensis.* Calcar about as long as free border of uropatagium, terminating in a small but distinct lobe; keel obsolete.

Fur and color.—Fur short, that on middle of back averaging a little less than 6 mm. in length, nearly unicolor on back but distinctly bicolor on belly. Back clove brown (lighter than No. 2 on Pl. III of Ridgway's Nomenclature of Colors), the hairs just perceptibly darker at base and with glossy tips, which in certain lights produce a slightly grizzled appearance. Belly light broccoli brown, the basal half of the hairs deep plumbeous. Ears and membranes blackish in dry skins. A series of ten skins from Huehuetan, Chiapas, shows no variation in color.

Skull.—The skull of *Myotis nigricans* (figs. 11*c* and 12*a*) is slightly smaller than that of *M. californicus*, and has a shorter rostrum and less frontal concavity in the dorsal outline. The differences are slight, but very evident when series are compared.

Teeth.—The teeth of *Myotis nigricans* do not differ appreciably from those of *M. californicus.*

Measurements.—The average measurements of 10 specimens of *Myotis nigricans* from Huehuetan, Chiapas are given in the following table:

Average measurements of 10 specimens of Myotis nigricans.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Chiapas, Huehuetan..........	10 ♀♀	76.7	35	13.6	6.9	33.5	4.4	57	12.7	8.6	6.6

Specimens examined.—Total number, 34; all from Huehuetan, Chiapas (altitude about 300 feet).

General remarks.—*Myotis nigricans* differs from *M. californicus* in numerous characters, each of which is trivial in itself but which with the others goes to make up a sum quite different from that shown by any other North American bat. The constancy in color of the 10 skins by which this species is represented in the Biological Survey collection is very remarkable.

MYOTIS SUBULATUS (Say). Say's Bat.

1823. ? ***Vespertilio subulatus*** Say, Long's Exped. to Rocky Mts., II, p. 65, footnote (Arkansas River, near La Junta, Colorado).
1864. ***Vespertilio subulatus*** H. Allen, Monogr. N. Am. Bats, p. 51.
1878. ***Vespertilio subulatus*** Dobson, Catal. Chiroptera Brit. Mus., p. 324.
1893. ***Vespertilio gryphus*** var. (b), Northern form of *Vespertilio gryphus*, H. Allen, Monogr. Bats N. Am., p. 80.
1897. ***Vespertilio gryphus*** var. ***septentrionalis*** Trouessart, Catal. Mamm. t. Vivent. q. Foss., p. 131. (Only name undoubtedly based on this animal.)

Type locality.—Arkansas River, near La Junta, Colorado.

Geographical distribution.—North America east of the Rocky Mountains.

General characters.—Size medium; length 80 to 90; forearm 34 to 37. Calcar slender, slightly longer than free border of uropatagium, terminating indistinctly or with a slightly developed lobule; keel rudimentary or absent. Free border of uropatagium naked. Ears long, reaching 2 to 5 mm. beyond tip of nose. Wings from base of toes.

Ears.—The ears (fig. 13 *a*) are long and slender, reaching when laid forward, 2 to 5 mm. beyond tip of nose. Anterior border straight from base to near middle, then for a varying distance moderately convex, finally straight to narrowly rounded off tip. Posterior border concave from point immediately below tip to about middle, where it becomes convex and continues so to basal notch. Basal notch strongly marked, isolating a narrow and very conspicuous lobe.

Tragus slender, straight, or slightly bent backward. Anterior border straight throughout or slightly convex near tip. Posterior border straight or evenly and slightly concave from tip to widest point, which is opposite or slightly above level of anterior base. Basal lobe small, width of tragus through lobe always much less than width at base of anterior edge.

Membranes.—The membranes are thin and translucent, naked except for a narrow line close to the body. On the uropatagium the furred region occupies the basal fourth dorsally, rather less ventrally, otherwise the membrane is naked except for scattered hairs along the veins. Wings from base of toes.

Feet.—The foot is moderately large, about half as long as tibia. Toes longer than sole, united by membrane at base to a little beyond middle of proximal phalanges, and sprinkled with coarse hairs on dorsal surface. Calcar slender, equal to or slightly longer than free edge of interfemoral membrane, terminating indistinctly or with an ill-defined lobe. Keel rudimentary or absent.

Fur and color.—The fur is full and soft, but shows no peculiarities in distribution. In color it apparently does not differ from typical *M. lucifugus;* but too few skins are now available to determine the limits of variation.

Skull.—The skull of *Myotis subulatus* resembles that of *M. evotis* so closely that it is impossible to distinguish with certainty between the two. In *M. subulatus* the skull is very slightly smaller, but the difference is trifling and intangible. The skull of *M. subulatus* does not closely resemble that of *M. lucifugus.*

Teeth.—The teeth of *Myotis subulatus* (fig. 15 *b*) agree in form and relative size with those of *M. evotis*, and I am unable to find any differences by which to separate them. They differ, however, in many details from the teeth of *M. lucifugus.*

Measurements.—See table on page 77.

Specimens examined.—Total number 53, from the following localities:

Alberta: Near Red Deer, 1 (skin, Miller coll.).
Illinois: Chicago, 1.
Indiana: Brookville, 1; Wheatland, 1.
Kentucky: Eubanks, 2.
Maine: Eastport, 2.
Maryland: Forest Glen, Montgomery County, 2 (Miller coll.).
Massachusetts: Woods Hole, 1.
Minnesota: Elk River, 2.
Missouri: Marble Cave, 9.
New York: Hammondville, 12 (Merriam coll.); Hemlock Lake, 1; Highland Falls, 1; Lake George, 3; Peterboro, 2 (Miller coll.).
Ontario: Mount Forest, 1 (skin, Miller coll.); North Bay, 1 (Miller coll.).
Pennsylvania: Meadville, 1.
Quebec: Godbout, 1 (Merriam coll.); Ottawa, 3 (Merriam coll.).
Tennessee: Bellamys Cave, 1.
Virginia: Alexandria, 1.
West Virginia: Aurora, 2 (Merriam coll.).
Wisconsin: Bayfield, 1.

General remarks.—*Myotis subulatus* may be distinguished from *M. lucifugus*, the only species with which it is likely to be confused, by its narrower skull, longer ears, and longer, more sharply pointed tragus.

MYOTIS SUBULATUS KEENII (Merriam).

1895. *Vespertilio subulatus keenii* Merriam, American Naturalist, XXIX, p. 860, September 1, 1895.

Type locality.—Massett, Queen Charlotte Islands, British Columbia. Type in U. S. National Museum (Biological Survey collection). Adult ♀, No. 72922 (in alcohol).

Geographic distribution.—*Myotis subulatus keenii* is at present known from the type locality only. It doubtless occurs throughout most of the humid northwest coast district.

General characters.—About the size of typical *Myotis subulatus*, but with longer tail and ears; color much darker than in true *subulatus*.

Ears.—The ears of *M. subulatus keenii* (fig. 13 *b*) average distinctly longer than those of typical *subulatus* from the eastern United States, but do not differ in form.

Fur and color.—The fur appears to be longer than in true *subulatus*, and considerably darker in color, but with alcoholic specimens only for comparison it is impossible to determine the degree of difference between the two forms. Membranes and ears blackish.

Measurements.—See table below.

Specimens examined.—Total number 3, all from the type locality.

General remarks.—*Myotis subulatus keenii* is a well-marked race, characterized, like the other bats of the humid northwest coast district, by darkness of color. In addition to its color differences it has longer ears than its eastern representative, in this respect showing much the same variation as *M. lucifugus alascensis*.

Measurements of subspecies of Myotis subulatus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
subulatus	New York: Hammondville	10	85.6	38.8	17.2	7.5	35.7	6.3	61	16.3	10.2	9.7
	Quebec: Godbout	2♂♂	80	36.8	16.4	7.5	33.8	6.5	58	15.6	9.8	9
	Missouri: Marble Cave	8	85.3	38.5	17.1	8	35.3	6.2	61	16.7	10.7	9.3
keenii	British Columbia: Massett	1♀[1]	86	41	16.4	8.8	36	6	60	17.4	11	9.6
	Massett	3	84.3	40.6	16.3	8.3	35.3	6	58	17.8	10.8	9.8

[1] Type.

MYOTIS EVOTIS (H. Allen). Long-eared Bat.

1864. *Vespertilio evotis* H. Allen, Monogr. Bats N. Am., p. 48.
1878. *Vespertilio evotis* Dobson, Catal. Chiroptera Brit. Mus., p. 324.
1893. *Vespertilio albescens evotis* H. Allen, Monogr. N. Am. Bats, p. 89.
1896. *Vespertilio chrysonotus* J. A. Allen, Bull. Am. Mus. Nat. Hist., VIII, p. 240, November 21, 1896. Kinney Ranch, Sweetwater County, Wyoming.

Type locality.—Not stated, and no type designated. In the original description specimens are mentioned from the upper Missouri River, and the Pacific coast from Puget Sound to Cape St. Lucas. Monterey, Cal. (one of the localities given), may be selected as the type locality.

Geographic distribution.—Austral and Transition zones from the Pacific Coast to the eastern edge of the Rocky Mountains; south to Vera Cruz.

General characters.—Size large; length 85 to 92; forearm 36 to 43. Calcar longer than free border of uropatagium, slender, distinct, and with a more or less well-developed lobule at the tip. Free border of uropatagium naked or very indistinctly ciliate. Ears very long, reaching 7 to 10 mm. beyond tip of nose. Wing from base of toes.

Ears.—The ears (Pl. I, fig. 6) are long and slender; laid forward they reach considerably (7 to 10 mm.) beyond tip of nose. Anterior border of auricle regularly convex from base to a point slightly beyond middle, thence straight or nearly so to the tip. Posterior border slightly concave immediately below tip of ear, then gradually and moderately convex to base. Basal lobe strongly developed, and notched on the lower border. The auricle is usually marked with three or four distinct cross ridges.

Tragus long, slender, and pointed. The anterior border straight or slightly concave from base to about mid height, then moderately convex, the terminal third or fourth usually straight. Posterior border with a small but distinct lobe at base. Above this lobe the margin bends abruptly outward for a varying distance, sometimes forming a sharp and conspicuous angle with the lower end of the concavity which extends downward from the tip of the tragus, in other cases separated from the latter by a region of varying extent in which the posterior and anterior borders are parallel. These variations bring about striking contrasts in the form of the lower part of the tragus in different individuals, and suggest the existence of more than one species or race. Specimens from approximately the same region, however, show both extremes and intermediate conditions.

Membranes.—The membranes are thin and light. Uropatagium hairy on basal fifth, otherwise naked except for a few hairs along the nerves and on the free border. Wing from base of toes (Pl. II, figs. 3 and 4).

Feet.—The feet are moderately large, slightly less than half as long as tibiæ. Toes (without claws) distinctly longer than sole and united by membrane through basal third of proximal phalanges. Whole dorsal surface of foot sprinkled with stiff hairs. Calcar distinct, equal to or longer than free border of uropatagium, terminating in a lobule of varying distinctness. Posterior border never distinctly keeled.

Fur and color.—The fur is full, soft, and not peculiar in distribution. It is light yellowish-brown, paler ventrally, the hairs everywhere dusky slate at base. The absence of a series of skins of this bat makes it impossible to describe the color accurately or compare it in detail with that of its allies, *M. thysanodes* and *M. subulatus*. A skin from Shuswap, British Columbia, has the fur of the back dull, pale raw umber, the dusky bases of the hairs showing through along the sides. The belly is light broccoli brown. In front of the shoulder and just below it is a small tawny olive area which contrasts strongly with the color of the belly. In another specimen (No. 1382, collection of Dr. C. Hart Merriam, San Bernardino Mountains, California, August 14, 1885, F. Stephens) the color is similar but a shade paler and yellower throughout, the dark bases of the hairs nowhere showing through. No dark shade in front of shoulder. This specimen is practically indistinguishable in color from the palest examples of *M. thysanodes*, but the fur is much darker at base and the general color is slightly clearer yellow, with the tips of the hairs more glossy. Other skins are duller and less yellow.

Skull.—The skull of *Myotis evotis* equals that of *M. thysanodes* in length and mastoid breadth, but is narrower across zygomata and has the occiput less elevated. The occipital outline is rounded as in *M. thysanodes*, and the occipital crest is very slightly developed. Forehead rising above the muzzle gradually, in this respect also resembling *M. thysanodes.* Rostrum more slender than in *M. velifer* or *M. thysanodes.* Pterygoids and posterior part of palatines as in *M. thysanodes.*

The skull of *Myotis evotis* is easily distinguished from that of all other North American species except *M. subulatus.* From the latter, however, it differs merely in very slightly larger size.

Teeth.—In dental characters *Myotis evotis* does not differ essentially from *M. thysanodes.* The premolars apparently show less tendency to crowding, but I can find no tangible difference in form or relative size (fig. 15 *c*).

Measurements.—The measurements of 8 specimens of *Myotis evotis* from eight localities are given in the following table:

Measurements of 8 specimens of Myotis evotis from 8 localities.

Locality.	Sex.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Washington: Easton	♂	85	41	19	8	36	7	62	19.4	11.8	10.8
Wyoming: Kinney Ranch	♀[1]	......	......	18	8.6	40	7	64	......	......	......
California: Inyo Mountains	♂	89	43	20	7	38	8	63	23	14.6	13
Owens Lake	♀	91	43	17.6	8	38	6.4	63	22	13.4	12.4
San Joaquin River	♂	92	43	19	8	38	6	62	22	13.6	12
Twin Oaks	♀	90	42	18.6	8	37	6.4	62	21	13	11
Nevada: Pahranagat Valley	♀	85	40	18	7.6	36.6	7	62	22	14.6	12
Vera Cruz: Perote	♂	91	42	20	9	40.4	6	67	20	12	11

[1] Type of *Vespertilio chrysonotus* J. A. Allen.

Specimens examined.—Total number 32, from the following localities:

Arizona: Chiricahua Mountains, 1 (skin, Am. Mus. Nat. Hist.); San Francisco Mountain, 1; Springerville, 2 (skins); White Mountains, 2 (skins, Am. Mus. Nat. Hist.).
British Columbia: Shuswap, 1 (skin).
California: Dulzura, 3 (2 skins, Miller coll., 1, Am. Mus. Nat. Hist.); Inyo Mountains, 1; Owens Lake, 1; San Bernardino Mountains, 1 (skin, Merriam coll.); North Fork San Joaquin River, 1; Twin Oaks, San Diego County, 1.
Chihuahua: San Luis Mts., 1 (skin).
Colorado: Loveland, 4 (2 skins, Miller coll.).
Montana: Hot Springs, 1.
Nevada: Cottonwood Range, 1; Pahranagat Valley, 1.
New Mexico: Vermejo River, 1 (skin).
Oregon: Blue Creek, 1; Harney, 1; Twelve Mile Creek, 1.
Vera Cruz: Perote, 1.
Washington: Easton, 1; Colville, 1.
Wyoming: Bull Lake (east of Fremont Peak), 1; Kinney Ranch, Sweetwater County, 1 (skin, Am. Mus. Nat. Hist., type of *V. chrysonotus* J. A. Allen).

General remarks.—*Myotis evotis* is so totally distinct from all other bats occurring in Mexico or the United States that no detailed comparison with any is needed. The only species with which it could be confused are *M. thysanodes* and *M. subulatus*. The ears, however, are much larger than in either of these, and the free border of the uropatagium is never densely haired, as in *M. thysanodes*.

Through the kindness of Dr. J. A. Allen, I have before me the type of *Vespertilio chrysonotus* from Kinney Ranch, Wyoming. I am unable to find that it differs in any way from *Myotis evotis*. The tail is mutilated so that it gives no characters. The forearm is only 2 mm. longe than in the largest *evotis* from the United States that I have seen, a difference too trivial to be taken into account. In color the type of *chrysonotus* is a barely perceptible shade yellower than skins of *evotis* from the San Bernardino Mountains, California, and Vermejo River, New Mexico, but the difference is wholly inconsequential.

MYOTIS THYSANODES sp. nov. Fringed Bat.

1893. *Vespertilio albescens velifer* (variety) H. Allen, Monogr. Bats N. Am., p. 93. Dulzura, California.

1893. *Vespertilio albescens evotis* H. Allen, Monogr. Bats N. Am., p. 90 (part, specimen No. 29827, from old Fort Tejon, California).

Type from Old Fort Tejon, California. Adult ♀ (in alcohol). No. 29827, U. S. National Museum (Biological Survey collection). Collected July 5, 1891, by T. S. Palmer. Original number, 235.

Geographic distribution.—Lower Sonoran zone from near the southern border of the Western United States to San Luis Potosi and Michoacan.

General characters.—In size nearly equal to *Myotis velifer*. Length, 85 to 95; forearm, 40 to 46. Calcar thick and distinct, usually terminating in a well-marked pointed projection. Free border of uropatagium thickened and densely haired. Ears moderately long; laid forward they reach 3 to 5 mm. beyond nostril. Wings from point between ankle and base of toes, but nearer latter.

Ears.—The ears (Pl. I, fig. 5) are moderately long and obtusely pointed; laid forward they reach 3 to 5 mm. beyond the tip of the nose. Anterior border of auricle straight or slightly convex through basal half, then more convex for a short distance, after which it is nearly straight to the rounded tip; posterior border at first straight or slightly concave, sloping rapidly backward to the widest point at about mid-height, below which the border becomes convex and continues so to the well-marked basal notch. Basal lobe distinct and moderately large.

Tragus long and slender, the anterior border straight or slightly concave at base, then straight or slightly convex to near the tip, just below which the border is always convex. Posterior border with a well-developed lobe at base, widest part of tragus through this lobe or immediately above it. A more or less developed notch above the lobe. Beyond this notch the border is at first strongly convex, then slightly concave below the tip, which is thus always bent backward. Posterior border indistinctly crenulate.

Membranes.—The membranes are moderately thick and dark colored. Uropatagium noticeably more leathery than wing membranes, distinctly thickened at free edge, sparsely haired on proximal fourth both above and below, the rest of the membrane with a few scattered hairs, which become more abundant toward the free border, where they form a conspicuous fringe both above and below (Pl. II, fig. 5). Wing from side of foot, just below base of toes.

Feet.—Feet (Pl. II, fig. 5) large and strong, half as long as tibiæ. Toes (without claws) slightly longer than sole, scarcely united by membrane at extreme base; all sparsely haired. Calcar distinct and thick, considerably longer than free border of interfemoral membrane, terminating distinctly, but usually without well-developed lobule.

Fur and color.—There is nothing peculiar in the distribution of the fur in this species, except the thickly haired border of the uropatagium.

In color the fur is everywhere light, dull, yellowish brown, distinctly paler ventrally, the hairs everywhere dusky slate at base. The color is subject to considerable individual variation in shade. The palest specimens are yellowish wood brown inclining to clay color; the darkest specimens dull raw umber. The belly varies from clear gray scarcely tinged with yellow to a strong yellowish gray, and in other specimens to dull brownish gray. The exact shades are very variable and impossible to describe accurately.

Skull.—Skull (fig. 11 *b*, and fig. 12 *b*) large, exactly the same size as that of *M. velifer*, but more lightly built. Brain case oval in outline, abruptly rounded posteriorly, occipital region inflated and lacking well-formed ridges. Forehead moderately elevated above muzzle. Distance from posterior border of last upper molar to tip of hamular greater than width between alveoli of posterior molars.

Although the skull of this species and that of *M. velifer* are equal in size, that of the former is easily distinguished by its more inflated brain case, forehead more abruptly elevated above muzzle and rounder less angular occiput. When viewed from above, the posterior margin of the brain case is rounded in *M. thysanodes*, truncate in *M. velifer*. When viewed from behind, the brain case in *M. thysanodes* is broader in proportion to its height than in *M. velifer* and lacks the conspicuous occipital crest of the latter. The posterior part of the palate, from the last molars to the tips of the hamulars, is shorter in proportion to the distance between the hindermost molars in *M. velifer* than in *M. thysanodes*.

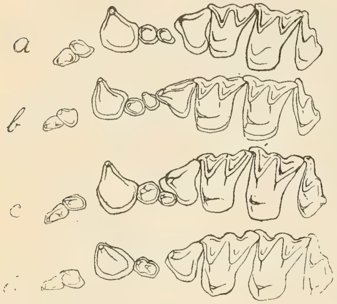


Fig. 16.—Maxillary teeth of four specimens of *Myotis thysanodes*, showing individual variation in form and position of premolars: *a*, specimen from Patzcuaro, Michoacan; *b*, *c*, and *d*, from Hacienda La Parada, San Luis Potosi (×5).

Teeth.—Upper incisors diverging at the tips. First and second upper premolars very variable in relative position and size. The first is always much longer than the second and has the crown at least one-fourth larger in cross section. The cross section of the first may, however, be nearly twice that of the second. In some specimens these two small premolars are perfectly in the line of the tooth row, the first in contact with the canine, the second touching the first, but separated from the third by a distinct space. In others the second premolar while perfectly in line is in contact with the third as well as with the first. Rarely the second premolar lies slightly external to the tooth row, while very commonly it is displaced to a varying degree inward, so much so in some cases as to be almost hidden from the outer side by the close approximation of the first premolar and the anterior edge of the third. These variations are independent of age and sex. The extremes with intermediates of all degrees occur among a dozen of the females collected by Mr. Nelson at Hacienda La Parada, San Luis Potosi, August 16, 1892; while specimens with teeth much worn or wholly unworn may have the premolars indifferently greatly crowded and displaced or wholly in the tooth row (fig. 15 *d*, fig. 16, and fig. 17.)

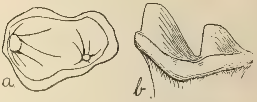


Fig. 17.—Abnormal premolar of *Myotis thysanodes* (No. 52228): *a*, crown; *b*, side (×20).

Third premolar triangular in outline, the outer border abruptly convex in front, and equal to posterior border; anterior and posterior borders concave; inner apex rounded, not extending back to level of inner margins of molars. First and second molars trapeziform, the anterior edge longest, the posterior outer and inner margins successively shorter. Anterior border straight to near inner edge, where it is bent abruptly backward, posterior border very slightly concave. First molar shorter and broader than second, and with anterior border nearly straight.

Central lower incisors with crowns compressed and trifid, the next pair similar but larger, the outer incisors still larger and with crowns indistinctly terete and quadrituberculate. First and second mandibular premolars variable in position and in relative size, the first always the larger. The second is shorter than the first, but in some specimens its crown has a cross section nearly equal to that of the latter. The first is always in contact with the canine and usually with the second premolar also, but may be separated from the latter by a narrow space. The second premolar is either wholly in the line of the tooth row and not touching the third, in line and touching the latter, or more or less displaced inward. Third premolar trapeziform, slightly broader than long.

In dentition *Myotis thysanodes* shows many points of difference from *M. velifer*. One of the most striking of these is the great variability in the size and position of the first and second upper premolars (figs. 16 and 17), which in *M. velifer* are comparatively constant. Other differences may be seen in the form of the third upper and third lower premolars. The crowns of the upper molars are proportionally broader in *M. velifer* than in *M. thysanodes*.

Measurements.—Average measurements of 23 specimens of *Myotis thysanodes* from four localities are given in the following table:

Average measurements of 23 specimens of Myotis thysanodes from 4 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
California: Old Fort Tejon	[1]1	87	36	18	8	41	6	69	18	12	11
Old Fort Tejon	10	87	37	17.6	8	41.2	6.3	69.2	17.6	11.8	10.5
Michoacan: Patzcuaro	3	89	37	16.7	8.9	41.8	6.7	71.5	18.3	11.9	10.8
San Luis Potosi: Hda. La Parada	10	90.4	36.9	17.4	8.9	42.7	6.7	73.6	18.5	12.2	10.5

[1] Type.

Specimens examined.—Total number 88, from the following localities:

California: Dulzura, 1 (skin, Miller coll.); Old Fort Tejon, 16.
Chihuahua: East side San Luis Mountains, 2 (skins).
San Luis Potosi: Hacienda La Parada, 62 (6 skins).
Michoacan: Patzcuaro, 5 (2 skins).
Jalisco: La Laguna, Sierra de Juanacatlan, 1 (skin); Sierra Nevada de Colima, 1 (skin, Am. Mus. Nat. Hist.).

General remarks.—*Myotis thysanodes* needs no close comparison with any other species occurring in Mexico or the United States. Its large size separates it from all others but *M. velifer*, while from the latter the ciliated free border of the uropatagium, peculiar thickened calcar, larger ears and paler color together with the cranial and dental characters readily distinguish it.

In certain respects *M. thysanodes* resembles *M. evotis*. The color is very much the same, while the ears in these two species reach their maximum development among the species of this genus found in North America. The free border of the interfemoral membrane in *M. evotis* shows a slight tendency to the ciliation so conspicuous in *M. thysanodes*. *Myotis evotis* is, however, a smaller animal and has ears proportionally longer than in *M. thysanodes*, while the free border of the interfemoral membrane is never distinctly ciliate.

That this species is the same as the South American *Myotis albescens* is exceedingly unlikely. Dobson, who has seen the type of the latter, gives for it the following characters, which do not in the least apply to the present species: "Ears shorter than the head; laid forward, the tips do not reach to the end of the muzzle; calcaneum feeble, termination indistinct; above dark brown." Moreover, Mr. Oldfield Thomas, who has compared specimens of *Myotis thysanodes* with the *albescens* in the British Museum, writes me that the two do not in the least resemble each other, and that *M. albescens* is allied rather to *M. velifer*. For further discussion of the question, see under the latter species.

In Dr. Harrison Allen's recent monograph (p. 93) a specimen of this species in my collection, taken at Dulzura, [misspelled Dalyura], Cal., is recorded as a variety of '*V. albescens velifer*.' A specimen from Old Fort Tejon, California, in the Biological Survey collection, is labeled by Dr. Allen '*V. subulatus*,' while fifteen others of the same species from the same locality are marked '*V. albescens?*.' One of the latter (No. 29827), however, is recorded as '*V. albescens evotis*' (p. 90).

Dr. T. S. Palmer has kindly furnished me with the following account of the colony from which the type of *Myotis thysanodes* was taken:

> In July, 1891, while one of the parties of the Death Valley Expedition was collecting at Old Fort Tejon, California, several species of bats were observed. The most abundant was a small *Vespertilio* [=*Myotis*], which could be seen at dusk flying about the oak trees near the old barracks in great numbers, and passing in and out of the ruined buildings. A long two-story adobe building, with the roof still intact, seemed to be the center of attraction, and about sundown bats could be seen streaming forth from a window in one of the gables. On the morning of July 5 an examination was made of the attic of this building, and the bats were found clinging to the ridgepole and the rafters, literally by thousands. Individuals of all ages, from recently born young to adults, were hanging together in bunches as big as a bushel basket. Others found concealment in cracks and crevices, but very few were flying about. Evidently the colony had occupied the attic for several years, but it was too dark to see whether more than one species was present.
>
> A sack was carried along under the ridgepole and specimens swept into it from several of the larger bunches. In this way more than a hundred bats were collected in a few minutes. As soon as they were disturbed they uttered a peculiar squeaking note and flew about in a confused manner in their efforts to escape. The sack was carried out under one of the oak trees and the specimens examined; 160 had been captured, and of these 25 were preserved[1] and the remainder allowed to escape. Some of the bats which had been given their liberty attempted to fly back to their retreat, but dazed by the sunlight took refuge in the branches of the nearest tree;

---

[1] Sixteen proved to be *Myotis thysanodes*: the others were *M. yumanensis*.

others made no attempt to escape, except to crawl up the trunks of the trees, where they remained until dark. Some of the young ones failed to find their way back to the building, and remained about the spot for several days.

Genus LASIONYCTERIS Peters.

1864. *Scotophilus* H. Allen, Monogr. N. Am. Bats, p. 27 (part, not *Scotophilus* Leach, 1821).
1865. *Lasionycteris* Peters, Monatsber. K. Akad. Wiss. Berlin, p. 648. Type *Vespertilio noctivagans* Le Conte.
1870. *Cnephaiophilus* Fitzinger, Sitzungsber. K. Akad. Wissensch., Wien, LXII, Abth., I, p. 8 (part).
1875. *Vesperides* Coues in Coues' and Yarrow's Zoology of Wheeler's Exped., p. 83. Type *Vespertilio noctivagans* Le Conte.
1878. *Vesperugo* Dobson, Catal. Chiroptera Brit. Mus., p. 183 (part).
1893. *Lasionycteris* H. Allen, Monogr. Bats N. Am., p. 104.

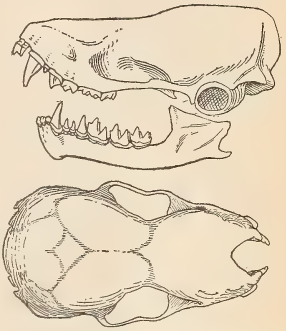


FIG. 18.—Skull of *Lasionycteris noctivagans* (×2.)

Type species.—*Lasionycteris noctivagans* (Le Conte).

Geographic distribution.—The range of the genus *Lasionycteris* is the same as that of the type and only known species.

Generic characters.—Dental formula: $i, \frac{2-2}{3-3}; c, \frac{1-1}{1-1}; pm, \frac{2-2}{3-3}; m, \frac{3-3}{3-3} = 36.$ Skull (fig. 18), flattened; rostrum very broad in proportion to brain case, strongly concave on each side back of the nasal aperture; dorsal profile of skull nearly straight and sloping gradually from external nares to occiput, which is scarcely angular, and always without sagittal crest. Ears short, nearly as broad as long; when laid forward, reaching barely to nostril; basal lobe very large. Tragus short, straight, and bluntly rounded at tip, width much more than half length of anterior margin. Back of interfemoral membrane furred on basal half. Mammæ, 2.

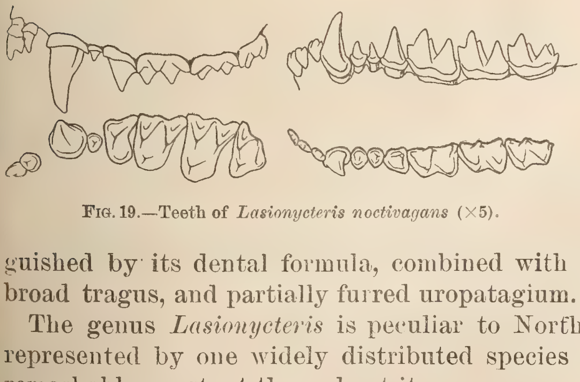


FIG. 19.—Teeth of *Lasionycteris noctivagans* (×5).

General remarks.—Among the American *Vespertilionidæ* the genus *Lasionycteris* is readily distinguished by its dental formula, combined with its short, broad ears, broad tragus, and partially furred uropatagium.

The genus *Lasionycteris* is peculiar to North America, where it is represented by one widely distributed species whose characters are remarkably constant throughout its range.

LASIONYCTERIS NOCTIVAGANS (Le Conte). Silver-haired Bat.

1831. *Vespertilio noctivagans* Le Conte, McMurtrie's Cuvier's Animal Kingdom, I, p. 31, June, 1831.

1831. *Vespertilio auduboni* Harlan, Monthly Amer. Journ. Geol. and Nat. Hist., I, p. 220, Pl. II, November, 1831 (Philadelphia, Pa.).

1835. *Vespertilio pulverulentus* Temminck, Monogr. de Mammalogie, II, p. 325 (Missouri River).

1864. *Scotophilus noctivagans* H. Allen, Monogr. N. Am. Bats, p. 39.

1865. *Lasionycteris noctivagans* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 648.

1878. *Vesperugo noctivagans* Dobson, Catal. Chiroptera Brit. Mus., p. 238.

1893. *Lasionycteris noctivagans* H. Allen, Monogr. Bats N. Am., p. 105.

Type locality.—Eastern United States.

Geographic distribution.—North America, from Atlantic to Pacific; probably not breeding south of the Transition Zone.

General characters.—See generic characters given on page 85.

Color.—The fur is deep, blackish, chocolate brown throughout, many of the hairs on the back, belly, and furred part of interfemoral membrane tipped with silvery white. The white tips are most numerous on middle of back. They are absent, or nearly so, from face, crown, and throat.

Skull and teeth.—The cranial and dental characters of *Lasionycteris noctivagans* have been sufficiently described in the diagnosis of the genus.

Measurements.—The average measurements of 21 specimens of *Lasionycteris noctivagans* from eight localities are given in the following table:

Average measurements of 21 specimens of Lasionycteris noctivagans from 8 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
New York: Sing Sing	10	105.8	42.4	17.1	7.9	41.1	5.3	73.4	15.9	14.1	6.7
Montana: Flathead Lake	2♀♀	100.5	41	16.2	7.5	42	4.5	75	15.6	14.1	6.2
Colorado: Rifle	1♂	97	38	16	8	39	4.6	68	16	12	6
Nevada: Badger	2♀♀	95.5	32.5	16	8.4	40	6.2	......	15.8	11.8	6
Oregon: Blue Mountains	1♂	97	39	16.4	8	41	6	......	15.4	11	5.6
Crooked River	1♂	95	41	17	7	41.4	5	......	16	12	6
Elgin	3	101	43	16.3	8.9	43	4.3	......	16	13.3	5.7
Harney	1♂	98	44	15	8.6	41	6	......	16	13	6

Specimens examined.—Total number 105, from the following localities:

Alberta: Henry House 2 (skins).
British Columbia: Sumas, 1 (skin, Miller coll.).
California: Nevada City, 1; Nicasio, 2.
Colorado: Rifle, 1.
Massachusetts: Nantucket, 1; North Truro, 6 (skins, Miller coll.).
Montana: Flathead Lake, 2.

Nebraska: Platte River, 1.
Nevada: Badger, 2.
New York: Lake George, 6 (2 skins); Leyden, 14; Locust Grove, 4; Lyons Falls, 4; Sing Sing, 47 (26 young).
North Carolina; Magnetic City, 1 (skin).
Oregon: Beaverton, 1 (skin, Miller coll.); Blue Mountains, 1; Crooked River, 1; East base Cascade Mountains, near Mount Thielson 1 (skin); Elgin, 3; Harney, 1; Salem, 1.
Pennsylvania: Carlisle, 1.

General remarks.—*Lasionycteris noctivagans* is one of the most easily recognized of North American bats. Its peculiar color alone is sufficient to distinguish it from all others found in the region where it occurs.

Genus PIPISTRELLUS Kaup.

1829. *Pipistrellus* Kaup, Skizzirte Entwick.-Gesch.,u. Natürl. Syst. d. Europ. Thierw., Th. I, p. 98. Type *Vespertilio pipistrellus* Schreber.
1839. *Vesperugo* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 312 (part).
1856. *Nannugo* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge II, 131, 169–172. Based on *nathusii, pipistrellus,* and *kuhlii.*
1856. *Hypsugo* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169. Included the species *maurus* and *krascheninikowii.*
1864. *Scotophilus* H. Allen, Monogr. N. Am. Bats, p. 27 (part, not *Scotophilus* Leach).
1878. *Vesperugo* Dobson, Catal. Chiroptera Brit. Mus., p. 183 (part).
1893. *Vesperugo* H. Allen, Monogr. Bats N. Am., p. 121.

Type species.—*Pipistrellus pipistrellus* (Schreber).

Geographic distribution of genus.—The greater part of the Eastern Hemisphere, and throughout the southern half of North America. Exact limits of distribution not known.

Generic characters.—Dental formula:

$$i, \frac{2-2}{3-3}; \ c, \frac{1-1}{1-1}; \ pm, \frac{2-2}{2-2}; \ m, \frac{3-3}{3-3} = 34.$$

Skull (figs. 21 and 22) small and lightly built, varying somewhat in form among the different species. Braincase usually more inflated than in *Vespertilio* and *Lasionycteris*, but rostrum proportionally as broad as in these genera. Ears (fig. 20) distinctly longer than broad and tapering to a narrowly rounded tip. Tragus straight or slightly curved forward. Back of interfemoral membrane sprinkled with hair on basal third. Mammæ, 2.

General remarks.—The members of the genus *Pipistrellus* may be recognized by their dental formula and small size. The bats of the European genus, *Pterygistes*[1] (*Pterygistes noctula* and *P. leisleri*), which have the same dental formula, are large, heavily built, and altogether different in appearance.[2]

---

[1] *Pterygistes* Kaup, Skizzirte Entwick.-Gesch. u. Naturl. Syst. d. Europ. Thierw., Th. I, p. 100, based on *Vespertilio proterus* Kuhl (=*V. noctula* Schreber) and *V. leisleri* Kuhl.

[2] For remarks on the generic characters of '*Noctulinia*' (=*Pterygistes*), see H. Allen, Proc. U. S. Nat. Museum, 1893, p. 30.

In America the genus is represented by three species, all of which are strictly congeneric with *Pipistrellus pipistrellus.* Of the American species *P. subflavus* resembles *P. pipistrellus* most closely, but is distinguishable at a glance by its much longer thumb.

KEY TO AMERICAN FORMS OF PIPISTRELLUS.

Tragus blunt with tip bent forward:
  Forearm about 31 mm.; colors very pale .... *hesperus* (p. 88)
  Forearm about 28 mm.; colors darker .... *australis* (p. 90)
Tragus tapering and straight:
  Forearm 30 to 32 .... *veræcrucis* (p. 93)
  Forearm 33 to 36—
    Color yellowish brown .... *subflavus* (p. 90)
    Color drab brown .... *obscurus* (p. 93)

PIPISTRELLUS HESPERUS (H. Allen).

1864. *Scotophilus hesperus* H. Allen, Monogr. N. Am. Bats, p. 43.
1878. *Vesperugo hesperus* Dobson, Catal. Chiroptera Brit. Museum, p. 228.
1886. *Vesperugo merriami* Dobson, Ann. & Mag. Nat. Hist., 5th ser., XVIII, p. 124.
1893. *Vesperugo hesperus* H. Allen, Monogr. Bats N. Am., p. 128.

Type locality.—Fort Yuma, Cal. Type No. 5406, U. S. National Museum.

Geographic distribution.—Lower Austral zone in the Western United States from western Texas to the Pacific Coast. Limits not known.

General characters.—Size very small (forearm about 26); thumb short (about one-eighth of forearm); ear shorter and more bluntly rounded than in other American members of the genus, reaching barely to nostril when laid forward; tragus blunt and distinctly bent forward at tip; feet very small, about half as long as tibia; barely 1 mm. of tip of tail free from membrane; color very pale.

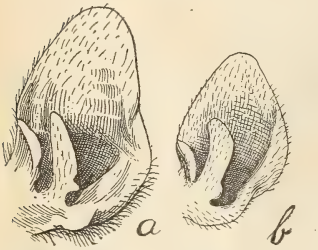


FIG. 20.—Ear of (*a*) *Pipistrellus subflavus* and (*b*) *P. hesperus* (×2).

Ears.—The ears (fig. 20 *b*) are short, reaching barely to nostril when laid forward. The anterior border of auricle is strongly convex from well developed basal notch to region about middle, where it becomes straight and remains so almost to narrowly rounded tip. Posterior border concave immediately below tip, then strongly convex to basal notch. Basal lobe well developed, separated from auricle by a deep notch and joining face at point below line of lips, and slightly behind posterior corner of eye. The fur of the head extends over dorsal surface of ear to slightly beyond the basal third. Otherwise the ear is naked except for a sprinkling of fine hairs on inner surface.

Tragus less than half length of ear, broadest just below tip; anterior border straight throughout greater part of its length, but strongly concave immediately below tip; posterior border strongly convex from tip almost to notch above well developed basal lobe.

Membranes.—The membranes are thin and delicate. Uropatagium very sparsely furred at extreme base, otherwise naked except for a few scattered hairs which are most numerous on the basal half. Wing membranes attached at base of toes. Uropatagium extending almost to extreme tip of tail.

Feet.—Foot small, distinctly less than half as long as tibia, naked or with a few almost invisible whitish hairs on dorsal surface. Calcar about as long as tibia, scarely keeled on posterior edge, terminal lobe absent or very indistinct.

Fur and color.—The fur extends on basal third of ears, but barely reaches extreme base of interfemoral membrane, and on wing membranes invades merely a very narrow strip close to body.

Color light yellowish gray or whitish gray, the fur everywhere deep plumbeous at base. In some specimens the hairs on the back have faint dark subterminal areas which, however, are visible on close inspection only. Ears, muzzle, face, and membranes black. A narrow whitish border on wing membrane between foot and fifth finger.

This species is apparently much more constant in color than *P. subflavus*, but the absence of a good series of skins leaves the range of individual variation in color a matter of uncertainty.

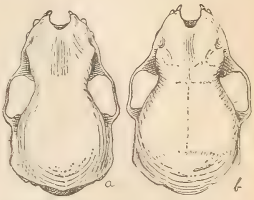


FIG. 21.—Top view of skull of (*a*) *Pipistrellus hesperus* and (*b*) *P. subflavus* (×2.)

Skull.—The skull of *Pipistrellus hesperus* (figs. 21 *a*, and 22 *b*) is very small, thin, and papery. That of an adult male from Fort Bowie, Arizona, measures 11.4 mm. in occipitonasal length, 6 mm. in zygomatic breadth, and 4 mm. in occipital depth. The dorsal outline is nearly straight from external nares to occiput, though there is a slight concavity between the orbits and a slight convexity over the brain case. Muzzle broad and nearly flat, slightly concave on each side of median line. In general the skull of *Pipistrellus hesperus* suggests a miniature of that of *Lasionycteris.*

Teeth.—The teeth of *Pipistrellus hesperus* (fig. 23 *a*) do not differ materially from those of *P. subflavus.* The anterior upper premolar is minute (much smaller than the smaller upper incisor) and usually thrown out of the tooth row by the second premolar, the anterior edge of which is generally in contact with the canine.

Measurements.—See table, page 95.

Specimens examined.—Total number 127, from the following localities:

Arizona: Beaverdam, 1; Fort Bowie, 1 (skin); Grand Cañon, 2; Guadalupe Cañon, Cochise County, 4 (skins); Little Colorado, 2; Dos Cabezas, 1 (skin); Keam Cañon, Navajo County, 1 (skin); New River, Maricopa County, 1; Yuma, 2.

California: Borax Flat, Mohave Desert, 3; Colorado Desert, 1 (skin); Death Valley, 4; Funeral Mountains, Inyo County, 1; Furnace Creek, Death Valley, 1; Grapevine Spring, Death Valley, 1; Independence, 1; Hot Springs Valley, Inyo County, 2; Jacumba, San Diego County, 2 (skins); Keeler, 1; Kern River, 3; Kernville, 1; Lone Pine, 3; Owens Lake, 1; Palm Springs, 3; Panamint Valley, Inyo County, 6; Panamint Mountains, 4; Poso Creek, Kern County, 1 (skin); Saline Valley, Inyo County, 1; San Emigdio, 1; Santa

Ysabel, San Diego County, 18; Three Rivers, 7; Twin Oaks, 2; Vallecitas, San Diego County, 3; Whitewater, 1 (skin); Yosemite Valley, 1; Old Fort Yuma, 1 (type).

Colorado: Grand Junction, 4.

Lower California: San Fernando, 7 (Miller coll.).

Nevada: Gold Mountain, Esmeralda County, 1; Pahranagat Valley, 1; Vegas Mountains, 1; Vegas Valley, Lincoln County, 1.

New Mexico: Dog Spring, Grant County, 7 (skins); Fort Wingate, 1; Grant County, 1 (skin).

Texas: Chinate Mountains, 1; El Paso, 4 (1 skin); Paisano, 5; Pecos River, 1.

Utah: St. George, 2.

Washinton: Almota, 1.

General remarks.—*Pipistrellus hesperus* is readily distinguishable among North American bats by its dental formula, small size, blunt tragus, and pallid color. It needs no comparison with any other species. At the southernmost extremity of its known range a subspecies slightly different from that occurring farther north has been differentiated. Otherwise the species is remarkably constant in all its characters.

PIPISTRELLUS HESPERUS AUSTRALIS subsp. nov.

Type from Barranca Ibarra, Jalisco, Mexico; altitude about 3,000 feet. Adult ♀ (in alcohol), No. 52112, U. S. National Museum (Biological Survey collection). Collected May 14, 1892, by E. W. Nelson. Original number, 2614.

General characters.—Slightly smaller than true *Pipistrellus hesperus;* fur shorter; color apparently darker and browner.

Ears, membranes, and feet.—As in the typical subspecies.

Fur and color.—The fur is shorter than in specimens of true *hesperus* taken in April and May, but in distribution it shows no peculiarities.

Color darker and browner than in specimens of true *hesperus* that have been immersed in alcohol for a similar length of time. Until skins of the southern animal are examined the actual color differences between the two forms can not be determined.

Measurements.—The measurements of the type and the averages of four specimens from the type locality are given in the table of measurements on page 95.

Specimens examined.—Four, all from the type locality.

General remarks.—*Pipistrellus hesperus australis* is a fairly well marked subspecies characterized by slightly smaller size, shorter fur, and darker color than in the typical form. The material by which it is represented is so poor, however, that all the characters can not be determined with certainty.

PIPISTRELLUS SUBFLAVUS (F. Cuvier). Georgian Bat.

1832. ?*Vespertilio georgianus* F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, p. 16. (Not determinable.)

1832. *Vespertilio subflavus* F. Cuvier, Nouv. Ann. Mus. d'Hist. Nat., Paris, p. 17. (Description good.)

1835–41. *Vespertilio erythrodactylus* Temminck, Monogr. de Mamm., II, 13me Monogr., p. 238.

1864. *Scotophilus georgianus* H. Allen, Monogr. N. Am. Bats, p. 35.

1878. *Vesperugo georgianus* Dobson, Catal. Chiroptera Brit. Mus., p. 235.

1893. *Vesperugo carolinensis* H. Allen, Monogr. Bats N. Am., p. 121 (not *Vespertilio carolinensis* Geoff.).

Type locality.—Eastern United States; probably Georgia.

Geographic distribution.—Austral zones and casually parts of Transition zone in the Eastern United States, from the Atlantic Coast west to Iowa and eastern and southern Texas.

General characters.—Size small (forearm, about 34); thumb long (about $\frac{1}{5}$ forearm); ear when laid forward reaching slightly beyond nostril; tragus straight, tapering to a broadly rounded tip; feet small, slightly more than half as long as tibia; terminal 2 mm. of tail free from membrane; hairs on back mostly distinctly tricolored; general color light yellowish brown, undulated with darker brown.

Ears.—The ears (fig. 20 *a*) are considerably longer than in *P. hesperus*, reaching, when laid forward, just beyond nostril. In general form the ear is much as in *P. hesperus*, but the auricle is slightly narrower, and the basal lobe is smaller and separated from auricle by a slight notch only. On dorsal surface of ear the fur of head extends scarcely to basal third. Otherwise the ear is naked except for a sprinkling of fine hairs on inner surface.

Tragus about half length of ear, broadest opposite anterior base and thence tapering gradually upward to bluntly rounded tip which is turned slightly backward. Anterior border slightly concave at base, then gently convex to tip. Posterior border slightly concave immediately below tip, then strongly convex almost to notch above well developed basal lobe.

Membranes.—The membranes are thin and delicate. Uropatagium thinly furred on basal fourth, otherwise naked except for a few scattered hairs along veins on lower side. Wing membranes attached at base of toes. Uropatagium attached at base of terminal caudal vertebra.

Feet.—Foot large, distinctly more than half as long as tibia, covered with conspicuous light-brown hairs on dorsal surface. Calcar distinctly longer than tibia, scarcely keeled on posterior edge, terminal lobe absent or very indistinct.

Fur and color.—The fur extends on base of ears and interfemoral membrane and on wing membranes to line joining knee and middle of forearm.

Color light yellowish brown, uniform on the ventral surface, but on the back clouded to a varying degree with darker brown. The hairs on the back appear to be of two kinds. The main body of the fur is made up of short hairs (about 6 mm. in length), which are deep plumbeus from base to a little below middle, then yellowish brown almost to extreme tip, which is dark brown. Intermixed with these shorter hairs are others which are much longer (about 10 mm. in length) and clear yellowish brown to extreme tip.

Typical *Pipistrellus subflavus* presents a wide range of individual variation in color. This is due to the extent of the terminal dark bands on the hairs of the back, and also to the exact shade of the yellowish subterminal bands. The yellowest specimens that I have seen were taken at Washington, D. C., during May and June.

Skull.—The skull of *Pipistrellus subflavus* (figs. 21 *a* and 22 *b*) is larger than that of *P. hesperus*. That of an adult male from Washington, D. C., measures 13 mm. in occipito nasal length, 8 mm. in zygomatic breadth, and 5 mm. in occipital depth. The dorsal outline is nearly straight from the anterior nares to a point immediately behind the orbits, then strongly convex to occiput. Muzzle narrow and arched, the concavities on each side nearly obsolete. In general the skull of *Pipistrellus subflavus* suggests a miniature of that of the smaller forms of *Vespertilio*.

Teeth.—The teeth of *Pipistrellus subflavus* (fig. 23 *b*) are larger than those of *P. hesperus* but essentially similar in form. The anterior upper premolar is large (about the size of the larger upper incisor) and generally fully in the tooth row.

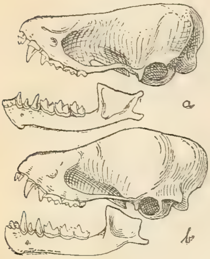


FIG. 22.—Side view of skull of (*a*) *Pipistrellus hesperus* and (*b*) *P. subflavus* (×2).

Measurements.—See table, page 957.

Specimens examined.—Total number, 213, from the following localities:

Alabama: Greensboro, 2.
District of Columbia: Washington, 17 (11 skins).
Indian Territory: Stilwell, 13.
Louisiana: Mer Rouge, 10; Houma, 2 (skins).
Maryland: Marshall Hall, 5 (skins); St. Georges Island, 2 (skins).
Mississippi: Washington, 8.
Missouri: Marble Cave, Stone County, 70.
New York: Sing Sing, 33.
North Carolina: Raleigh, 7 (skins); Bertie County, 2 (skins).
Pennsylvania: Carlisle, 7 (1 skin).
Tennessee: Hickman County, 1 (skin); Arlington, 3; Big Sandy, 10; Danville, 4.
Texas: Clear Creek, Galveston County, 1; Brownsville, 1.
Virginia: Cedarville, 6 (skins, Miller coll.): Fredericksburg, 6 (skins): Hampshire County, 1 (skin); Wytheville, 2.

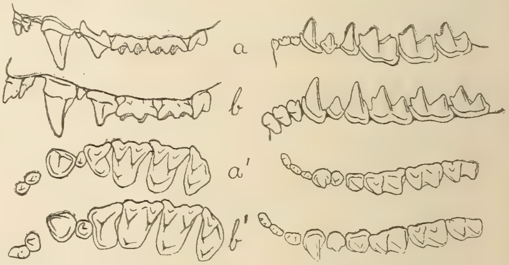


FIG. 23.—Teeth of (*a*) *Pipistrellus hesperus* and (*b*) *P. subflavus* (×5).

General remarks.—The Georgian bat, *Pipistrellus subflavus*, is so readily distinguished among the species of the region it inhabits that detailed comparisons are scarcely necessary. Its dental formula, small size, relatively large thumb, distinctly tricolored fur and general yellowish color are unmistakable characters.

PIPISTRELLUS SUBFLAVUS OBSCURUS subsp. nov.

Type from Lake George, Warren County, N. Y. Adult ♀ (skin) No. 67723, U. S. National Museum (Biological Survey collection). Collected September 6, 1894, by Walter K. Fisher. Original number, 198.

General characters.—Size and proportions as in typical *subflavus*, but color duller and less yellow, and dark tips of shorter hairs on back more conspicuous.

Ears, membranes, feet, and fur.—As in typical *subflavus.*

Color.—Fur everywhere blackish slate at base. Middle band on shorter hairs of back dull, pale, wood brown or isabella color. Tips of these hairs dusky brown, and much more conspicuous than in true *subflavus.* Long hairs of back pale wood brown. Belly uniform isabella color, in some specimens inclining toward wood brown, but seldom showing any approach to the bright yellowish brown of true *subflavus.*

A melanistic specimen is dark chocolate brown throughout. Two others are rich reddish brown. In all three of these abnormal individuals the characteristic variegation of the fur of the back still persists.

Skull and teeth.—I can find no cranial or dental characters to distinguish *Pipistrellus subflavus obscurus* from the typical subspecies.

Measurements.—See table, page 95.

Specimens examined.—Thirty four (seven skins), all from the type locality.

General remarks.—*Pipistrellus subflavus obscurus* is readily distinguishable from true *subflavus* by its darker, duller, less yellow color. The difference is especially noticeable on the ventral surface, which is generally a rich yellowish wood brown in typical *subflavus*, dull isabella color in *obscurus.* The darker hue of the back in *obscurus* is due partly to differences in the color of the long hairs, and of the middle bands of the short hairs, and partly to the more extended dark tips of the short hairs. Like the typical form, *Pipistrellus subflavus obscurus* varies considerably in color, so that individual specimens of either subspecies, especially those that are not fully adult, are sometimes difficult to identify. When series are compared, however, the differential characters at once become apparent.

PIPISTRELLUS VERÆCRUCIS (Ward).

1891. *Vesperugo verœcrucis* Ward, Am. Naturalist, XXV, p. 745, August, 1891.

Type locality.—Las Vegas, Jalapa, Vera Cruz.

Geographic distribution.—This species is known from the type locality only.

Characters.—As I have seen no specimens of *Pipistrellus verœcrucis*, I copy the original description.

> All six specimens were indistinguishable one from another in point of color. The following color-description is taken from a dried skin, whereas all the rest of the description is taken from a specimen preserved in alcohol.

Hairs of back clove-brown for basal half, followed by two equal zones respectively broccoli-brown and clove-brown; some of hairs furthermore tipped with light Vandyke-brown, giving a decidedly "rusty" tone to the back. Ventral surface; bases of hair slightly lighter than those of back, followed by light-hair brown, producing a grayish or smoky effect.

Wing membranes naked; except a very limited area on upper surface along sides of body, not exceeding 3 or 4 mm. in width; and on lower surface, the area included between a line passing from the middle of humerus to the knee and the side of the body is scantily haired.

Interfemoral membrane with a small, triangular patch of hair on its upper surface, covering base of tail, and extending to one-fourth of its length.

Legs and arms naked. Wing extending from base of outer toe. Antebrachial membrane losing itself at middle of radius. Two caudal vertebræ free from membrane.

Black glandular prominences between eyes and nostrils well developed, fringed with longish hairs on both upper and lower edges, and with three or four long, black, bristly hairs growing from its upper surface.

Inner edge of ear conch evenly convex. Outer edge coming up in an even, sweeping curve from angle of mouth to level of tip of tragus, where it meets a slightly concave line leading up to the obtusely rounded tip. A nearly semi-circular antitragus is developed from that part of the conch passing below the tragus. Bone of inner margin of tragus concave, thus throwing this organ forward, followed by a straight margin. Bone of outer margin with a subtriangular lobe, followed by a deep notch, above which the greatest width is quickly reached. From here a nearly straight line leads to the tip, which is obtusely rounded.

Measurements in millimeters: Length of head and body, from tip of nose to base of tail, 37.5; length of tail, 36; length of tail beyond membrane, 3; length of head, 15; height of ear, from notch between antitragus and conch to tip, 10; height of tragus, inner margin, 4.5; height of tragus, outer margin, 6; greatest width of tragus, 2; length of antitragus, 2; height of antitragus (approximately), .75; length of forearm, 31; length of thumb, including claw and excluding metacarpus, 7.5. Second digit—metacarpal, 29. Third digit—metacarpal, 30.5; first phalanx, 11.5; second phalanx, 11; cartilaginous tip, 5. Fourth digit—metacarpal, 29; first phalanx, 10; second phalanx, 7; cartilaginous tip, 2.5. Fifth digit—metacarpal, 28; first phalanx, 8.5; second phalanx, 5; cartilaginous tip, 1. Interspace between tips of third and fourth digits, 16; interspace between tips of fourth and fifth digits, 37; interspace between tip of fifth digit and juncture of membrane with foot, 42; extent of outstretched wings, 212; length of tibia, 13.5; length of foot, 9; length of calcaneum, about 8.

Teeth, $\frac{2-2}{3-3}$, $\frac{1-1}{1-1}$, $\frac{2-2}{2-2}$, $\frac{3-3}{3-3} = 30$ [34].

Middle upper incisors separated by 1.5 mm., inclined forwards and inwards; a large internal cusp on posterior-external edge halfway up from base to tip. Outer incisors simple, conical, inclined parallel to their respective inner mates, separated from canines by about .75 mm. Lower incisors tri-lobate, evenly spaced. Upper canines long, simple, slightly recurved. Lower canines straight, with basal cusps on forward edge only. First upper premolar interior to tooth line, visible from the exterior. Second upper premolar longer than any of its corresponding molars.

A prominent conical excrescence is on the lower gum, opposite the space between the premolars, in front of which the point of the upper canine passes. Two much less prominent excrescences are on the upper gum immediately above this lower one. Type No. 527 ♂, Las Vegas, V[era Cru]z, February 19, 1891. Collectors, H. L. Ward and C. M. Teran.

General remarks.—Pipistrellus veræcrucis differs from *P. subflavus* in its smaller size, relatively longer thumb, and browner, less yellow color.

No specimens of this species have been obtained by the field agents of the Biological Survey, nor are any known to be in American museums.

Average measurements of North American forms of Pipistrellus.

Name.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
hesperus	Washington: Almota	1♀	77	32	12	6	30	4	52	12.4	9	5.4
	California: Fort Yuma	[1]1♂	70	28	11	5	28	3.8	48	10	8.6	4.6
	Santa Ysabel	10	72.8	32	11.5	5.5	31.6	4	51.4	11.6	8.7	5.2
	Colorado: Grand Junction	4	74.6	31	12	5.5	31.3	4	52	12.1	9.3	5.4
	Texas: Paisano	3	79	34.5	12.8	5.4	32.5	4	55.5	12.4	9.6	5.1
australis	Jalisco: Barranca Ibarra	[1]1♀	64	28	11.4	5	29	4	47	10.4	8.4	5
	Barranca Ibarra	4	63.2	26.8	10.7	5.1	28.6	3.9	45	10.7	8	4.5
verœcrucis	Vera Cruz: Las Vegas, Jalapa.	[1]1	73.5	36	13.5	9	31	7.5	58	....	....	6
subflavus	Louisiana: Mer Rouge	10♀♀	85.1	40.7	15.3	7.9	34.6	6.8	60.8	14.2	9.8	6.6
	Missouri: Marble Cave	10	84.6	39.8	16.1	8.1	33.7	6.8	60	13.9	9.5	6.4
	District of Columbia: Washington.	5♀♀	84	37.8	15.2	7.8	34	6.8	62.8	14	9.6	6.6
obscurus	New York: Lake George	10	84.8	38.9	15.2	8	36	6.8	60.6	14	10	6.8

[1] Type; measurements by original describer.

Genus VESPERTILIO Linnæus.

1758. *Vespertilio* Linnæus, Systema Naturæ, 10th ed., I, pp. 31–32. Type by elimination *Vespertilio murinus* Linnæus (not *V. murinus* Schreber, 1775).

1820. *Eptesicus* Rafinesque, Annals of Nature, p. 2. Type *Eptesicus melanops* Rafinesque (=*Vespertilio fuscus* Beauvois).

1829. *Cnephæus* Kaup, Skizzirte. Entw.-Gesch. u. Natürl. Syst. d. Europ. Thierw., I, p. 103. Type *Vespertilio serotinus* Schreber.

1839. *Vesperugo* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 312 (part).

1839. *Vesperus* Keyserling & Blasius, Wiegmann's Archiv f. Naturgesch., 5ter Jahrg., Bd. 1, p. 313. Based on the 32-toothed species of '*Vesperugo*.'

1841. *Noctula* Bonaparte, Iconografia Fauna Italica, I, fasc. XXI, under *Vespertilio alcythoe*. Type '*Vesperugo*' *serotinus*.

1856. *Cateorus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 162–163. Type '*Vesperugo*' *serotinus*.

1856. *Meteorus* Kolenati, Allgem. Deutsch. Naturhist. Zeitg., Dresden, Neue Folge, II, pp. 131, 167–169 (included *nilssoni, discolor, savii, leucippe, aristippe*).

1864. *Scotophilus* H. Allen, Monogr. N. Am. Bats, p. 27 (part).

1878. *Vesperugo* Dobson, Catal. Chiroptera Brit. Mus., p. 183 (part).

1892. *Adelonycteris* H. Allen, Proc. Acad. Nat. Sci. Phila. (1891), p. 466, Jan. 19, 1892. (Proposed as a substitute for *Vesperus*, preoccupied in Entomology).

1893. *Adelonycteris* H. Allen, Monogr. Bats, N. Am., p. 111.

Type species.—*Vespertilio murinus* Linnæus (= *V. discolor* Natterer) —not *V. murinus* Schreber.

Geographic distribution.—Boreal, Austral and parts of Tropical regions in both hemispheres.

Generic characters.—Dental formula: $i, \frac{2\text{-}2}{3\text{-}3}; c, \frac{1\text{-}1}{1\text{-}1}; pm, \frac{1\text{-}1}{2\text{-}2}; m, \frac{3\text{-}3}{3\text{-}3}=32.$ Skull (figs. 24 and 25) large and heavily built; rostrum broad in proportion to brain case (less so than in *Lasionycteris*), scarcely concave at sides back of nasal aperture; dorsal profile nearly straight, rising gradually from external nares to occiput, which in the adult is strongly angular and provided with a conspicuous sagittal crest. Ears short, considerably narrower than long, basal lobe well developed, but not excessively large. Tragus straight, short, directed slightly forward, broadest near the middle and tapering to a moderately sharp point. Back of interfemoral membrane wholly naked except for a sprinkling of hairs on basal fourth. Mammæ, 2.

General remarks.—The genus *Vespertilio* contains the largest American species of the Vespertilionine group. Aside from the dental formula, the large size of *Vespertilio fuscus*, the only known North American species, is sufficient to distinguish the genus among those occurring in the region now under consideration.

The North American species is separable into at least five tolerably well-marked subspecies as follows:

KEY TO THE SUBSPECIES OF VESPERTILIO FUSCUS.

Size small (total length, 96 to 107; forearm, 40 to 45; longest finger, 68 to 77).
  Breadth of muzzle greater than half length of head.........*propinquus* (p. 100)
  Breadth of muzzle less than half length of head..............*bahamensis* (p. 101)
Size large (total length, 105 to 122; forearm, 43 to 52; longest finger, 77 to 96).
  Membranes and ears thick and leathery, the ears distinctly thickened along anterior border..*fuscus* (p. 96)
  Membranes and ears thin, the ears scarcely thickened along anterior border.
    Forearm, 47 to 50; longest finger, 85 to 89 (average 86)......*cubensis* (p. 102)
    Forearm, 50 to 52; longest finger, 85 to 96 (average 90) ..*miradorensis* (p. 99)

VESPERTILIO FUSCUS Beauvois. Brown Bat.

1796. *Vespertilio fuscus* Beauvois, Catal. Peale's Museum, p. 14. (Philadelphia, Pa.).
1806. *Vespertilio carolinensis* Geoffroy, Ann. Mus. d'Hist. Nat., Paris, VIII, p. 193. (Carolina.)
1818. *Vespertilio phaiops* Rafinesque, Am. Monthly Mag., III, p. 445. (Kentucky.)
1820. *Eptesicus melanops* Rafinesque, Annals of Nature, p. 2. (Kentucky.)
1823. *Vespertilio arquatus* Say, Long's Expedition to Rocky Mountains, I, p. 167, footnote.
1835. *Vespertilio ursinus* Temminck, Monogr. de Mammalogie, II, p. 235.
1843. *Scotophilus greenii* Gray, List Spec. Mamm. Brit. Mus., p. 30 (nomen nudum).
1864. *Scotophilus fuscus* H. Allen, Monogr. N. A. Bats, p. 208.
1878. *Vesperugo serotinus* var. *Vesperus fuscus* Dobson, Catal. Chiroptera Brit. Mus., p. 193.
1893. *Adelonycteris fuscus* H. Allen, Monogr. Bats N. A., p. 112.

Type locality.—Philadelphia, Pa.

Geographic distribution.—Austral, Transition, and (lower edge of) Boreal zones throughout the United States and adjoining British provinces.

General characters.—Size large; total length, 110 to 112; tail vertebræ, 41 to 52; forearm, 43 to 46; longest finger, 77 to 84; ear, 11.6 to 14;

ears and membranes thick and leathery; crowns of upper molars narrow; color variable, but seldom very dark.

Ears.—Ears short, reaching barely to nostril when laid forward, furred on basal third above and sprinkled with hairs on most of inner surface, but especially near an terior border. The membrane of the ear is heavier and more leathery than in the southern subspecies, and the anterior edge is distinctly thickened.

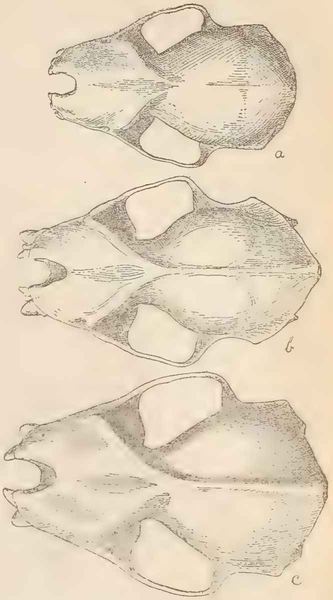


FIG. 24.—Top view of skull of (*a*) *Vespertilio bahamensis*, (*b*) *V. fuscus*, and (*c*) *V. serotinus* (×2).

Membranes.—Membranes naked, broad and ample, that of wings attached to foot a little beyond base of toes. Free edge of interfemoral membrane a little shorter than calcar and terminating at base of penultimate caudal vertebra. The flight membranes, like the ears, are thicker and less membranaceous than in the subpecies occurring in or near the tropics.

Feet.—Foot about half length of tibia; calcar slightly longer than foot, keeled on outer edge, and terminating indistinctly or in a faintly defined lobe. Dorsum of toes with a few short bristle-like hairs.

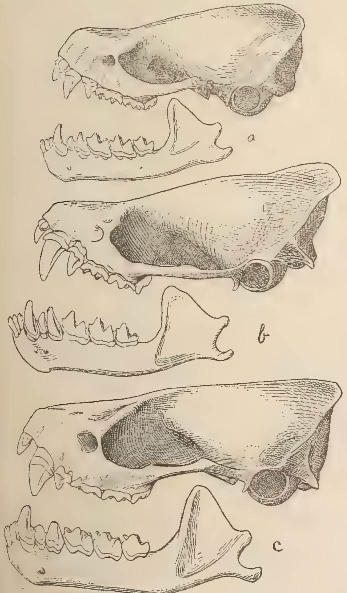


FIG. 25.—Side view of skull of (*a*) *Vespertilio bahamensis*, (*b*) *V. fuscus*, and (*c*) *V. serotinus* (×2).

Fur and color.—On middle of back the fur is about 12 mm. long. The fur extends along the sides in a line about 10 mm. wide on wing membranes both above and below. The proximal third or fourth of uropatagium is furred. Otherwise the membranes are naked except for a few scattered hairs on the under side of the interfemoral membrane and on the under side of the wings close to the humerus and forearm.

Color brown throughout, but always paler on belly than on back. The exact shade varies considerably, but is usually a clear bister or sepia. Sometimes, however, it approaches cinnamon. Ears and membranes blackish in dry specimens.

Skull.—The skull of typical *Vespertilio fuscus* (figs. 24 *b*, 25 *b*) averages about 18.5 mm. in occipito-nasal length and 12.5 mm. in zygomatic breadth; mandible, 14 mm. It has no tangible characters to distinguish it from the skulls of the other large subspecies.

Teeth.—The teeth of typical *Vespertilio fuscus* (fig. 26 *a*) do not differ appreciably in form or size from those of the other large continental subspecies. They average slightly smaller, however, than in *V. fuscus miradorensis*, and the crown of the middle upper molar is usually narrower.

Measurements.—See table, page 103.

Specimens examined.—Total number, 336, from the following localities:

Alabama: Greensboro, 1.
Arkansas: Fort Towson, 1.
Arizona: Apache, 4; Santa Catalina Mountains, 3 (skins); Chiricahua Mountains, 1 (skin); Guadalupe Cañon, Cochise County, 2 (skins); Fort Verde, 2 (1 skin); Fort Huachuca, 9; Huachuca Mountains, 4 (skins); New River, 2; San Francisco Mountain, 6; Yuma, 1.
British Columbia: Ashcroft, 2 (skins).
California: Bear Valley, San Bernardino County, 2; Cassel, 2; Cloverdale, 1; Dulzura, 3 (1 skin); Horse Corral Meadows, Fresno County (altitude, 8,000 feet), 1; Kern Lakes, North Fork Kern River (altitude, 7,000 feet), 1; Kern River, 6; Kernville, 1; South Fork Kings River, 2; Lone Pine, 7; Little Kern River, 3; Mount Shasta, 2 (skins); Mount Whitney, 2; Nevada City, 6; Nicasio, 63; Owens Lake, 1; Old Fort Tejon, 1; Pine Valley, 4 (skins); Poso Creek, Kern County, 1 (skin); Round Valley, 1; Raymond, 2; Santa Barbara, 2; Sequoia National Park, 9; Sherwood, 1; Twin Oaks, San Diego County, 3; Three Rivers, 1; Tehachapi, 1; Visalia, 2; Walker Basin, Kern County, 4; Yosemite Valley, 2.
Colorado: Loveland, 6 (skins, Miller coll.).
Connecticut: Norfolk, 2.
District of Columbia: Washington, 53 (33 skins).
Georgia: Riceboro, 1.
Idaho: Fort Sherman, 1.
Illinois: Richland County, 1; Warsaw, 4.
Kansas: Fort Riley, 2; Neosho Falls, 1 (skin).
Maine: Eastport, 4.
Massachusetts: Cambridge, 4; Wilmington, 6 (skins).
Mississippi: Bay St. Louis, 2.
Missouri: Marble Cave, Stone County, 5; St. Louis, 1.
Montana: Big Snowy Mountains, 1; Prospect Creek, 2; Kalispell, 2; Milk River, 1.
Nevada: Pyramid Lake, 4; Carson Valley, 1.
New Hampshire: Charlestown, 1.
New York: Hammondville, 6; Sing Sing, 13.
Ontario: Toronto, 1 (skin).
Oregon: Anna Creek, 3; Des Chutes River, 4 (skins); Fort Klamath, 2.
Pennsylvania: Carlisle, 1; Center County, 2 (skins).
South Dakota: Smithville, 5; Custer, 1; Cheyenne River, 1; Fort Pierre, 1; Fort Meade, 1.
Texas: Brazos River, 1.
Utah: Cache County, 1; Laketown, 1; Ogden, 5; St. George, 4.
Washington: Spokane Bridge, 2; Geyser Basin, 1.

General remarks.—In size and general appearance typical *Vespertilio fuscus* occupies a somewhat intermediate position among the North American subspecies. It is considerably smaller than *miradorensis* and much larger than *propinquus* and *bahamensis*. Very pallid specimens are occasionally taken in the Southwestern United States, but the number of skins available for comparison is so small that it is impossible to determine the status of the form which these aberrant individuals represent.

Vespertilio fuscus and *V. serotinus* have been considered by many writers as races of a circumpolar species. Six specimens of the serotine—four from Budapest, Hungary, and two from Berne, Switzerland—kindly sent me by Mr. Oldfield Thomas, of the British Museum, prove conclusively that this view of the relationship of the two animals is untenable. The differences between the American and European forms are so great that, taken in connection with the complete geographic isolation which undoubtedly exists, they leave no doubt of the necessity of recognizing each as a distinct species. *Vespertilio serotinus* is a large and heavily built animal, approached in size by *V. fuscus miradorensis* alone among the races of *V. fuscus*. The adult females from Budapest measure, respectively: Total length, 131 and 134; tail vertebræ, 52 and 53; tibia, 22.8 and 22.6; foot, 10 and 11; forearm, 52 in each; thumb, 8.4 and 8; longest finger, 93 and 96; ear from meatus, 20 in each; width of ear, 13 and 14; tragus, 9 and 8.6. In addition to its large general size *V. serotinus* has relatively much larger skull and teeth than any of the races of *V. fuscus* (see figs. 24, 25, and 26). The skull of an adult female from Budapest (No. 4489, Miller coll.) measures: Occipito-nasal length, 21.4; zygomatic breadth, 15; mandible, 17; upper tooth row (exclusive of incisors), 8; lower tooth row, 10. The skull is considerably broader in proportion to its length than in *V. fuscus*, and the audital bullæ are relatively smaller. The teeth are much larger than those of *Vespertilio fuscus*, and the inner lobes of the upper molars are broader, in this respect approaching *V. fuscus cubensis*. The upper incisors are separated from the canines by a wider space than in *fuscus*, and this space subtends a distinct groove on the surface of the premaxilla between the roots of the canine and incisors. The paroccipital processes are much more strongly developed in *V. serotinus* than in any of the races of *V. fuscus*.

VESPERTILIO FUSCUS MIRADORENSIS (H. Allen).

1866. *Scotophilus miradorensis* H. Allen, Proc. Acad. Nat. Sci., Phila., p. 287.

Type locality.—Mirador, Vera Cruz, Mexico. Type = 5411 in the United States National Museum, but now mislaid or lost.

Geographic distribution.—Costa Rica, Guatemala, and southern Mexico. Limits of range not known.

General characters.—Size larger and color darker than in the more northern form. Feet and distribution of fur as in true *fuscus*; ears and membranes thinner and more membranaceous.

Color.—In color *Vespertilio fuscus miradorensis* averages darker than true *fuscus*, thus agreeing with the other southern forms, *propinquus* and *cubensis*.

Skull.—The skull of *Vespertilio fuscus miradorensis* is slightly larger and somewhat less flattened than that of true *fuscus*. The skull of an adult male from Tehuacan, Puebla, measures: Occipito-nasal length, 19.5 mm.; zygomatic breadth, 13; mandible, 14.5. The occiput, although developing even more strongly marked ridges than in the typical subspecies, appears less sharply 'peaked' behind when viewed from the side.

Teeth.—The teeth are heavier than in true *fuscus*, and the crown of the middle upper molar is broader on its inner side, but no tangible dental characters can be established to separate the large subspecies.

Measurements.—See table, page 103.

Specimens examined.—Total number, 17, from the following localities:

Costa Rica: San José, 1.
Guatemala: Zuñil, Quezaltenango, 1.
Mexico: Valley of Toluca, 2 (skins); Ixtapalapa, 2.
Oaxaca: Cerro San Felipe, 1; Oaxaca, 1.
Puebla: Tehuacan, 3 (1 skin).
Tlaxcala: Mt. Malinche, 1.
Vera Cruz: Jico, 1; Las Vigas, 2; Tuxpango, 2 (skins).

VESPERTILIO FUSCUS PROPINQUUS (Peters).

1872. *Vesperus propinquus* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 262.
1878. *Vesperugo propinquus* Dobson, Catal. Chiroptera Brit. Mus., p. 203.

Type locality.—Santa Ysabel, Guatemala.

Geographic distribution.—In addition to the type the only known specimen of *Vespertilio fuscus propinquus* is from Greytown, Nicaragua.

General characters.—Size very small (total length, 96 to 105; tail vertebrae, 37 to 45; longest finger, 68; ear, 14 to 15): breadth of muzzle distinctly more than half length of head; colors dark.

Ears.—The ears in *Vespertilio fuscus propinquus* are proportionally shorter and broader than in typical *fuscus*, and the tips are distinctly more broadly rounded. They are haired in exactly the same manner as in true *fuscus*. The ear membranes are thin and membranaceous, like those of the other southern races.

Membranes and feet.—Except for their smaller size, the membranes and feet are exactly as in true *fuscus*, though the membranes, like the ears, are thinner and less leathery.

Fur and color.—The fur is shorter than in true *fuscus*, averaging only about 7 mm. on back. There is nothing peculiar in its distribution. In the single alcoholic specimen that I have seen the color is about as in *V. fuscus miradorensis*. Peters, however, describes the color of the type specimen as rust red.[1] This is much brighter than the Greytown specimen, but the color may be due to staining while in alcohol.

Measurements.—See table, page 103.

Specimens examined.—I have seen only one specimen of *Vespertilio fuscus propinquus*. This was collected by Mr. Charles W. Richmond at Greytown, Nicaragua (♀ ad., No. 52790, U. S. National Museum, Dept. of Agriculture collection).

---

[1] "Oben rostroth, die Haare an der Basis schwarzbraun, Bauchseite blasser, indem die an der Basis schwarzbraunen Haare hier mehr rostgelbe Spitzen haben."

General remarks.—Among the races of *Vespertilio fuscus*, *V. fuscus propinquus* differs most widely in size and in form of head from its nearest geographical ally, *V. fuscus miradorensis.* It combines the small size of the West Indian *bahamensis*, the broad muzzle of true *fuscus*, and the delicate ears and membranes of the southern races in general. Additional material may show that it is specifically distinct.

VESPERTILIO FUSCUS BAHAMENSIS subsp. nov.

Type from Nassau, New Providence, Bahamas. Adult ♂ (in alcohol) No. 76537, U. S. National Museum (Biological Survey collection). Collected in the spring of 1894 by C. J. Maynard.

Geographic distribution.—This form is known from the type locality only.

General characters.—Size about as in *V. fuscus propinquus*: breadth of muzzle less than half length of head; ears narrower than in *propinquus*, about as in typical *fuscus*.

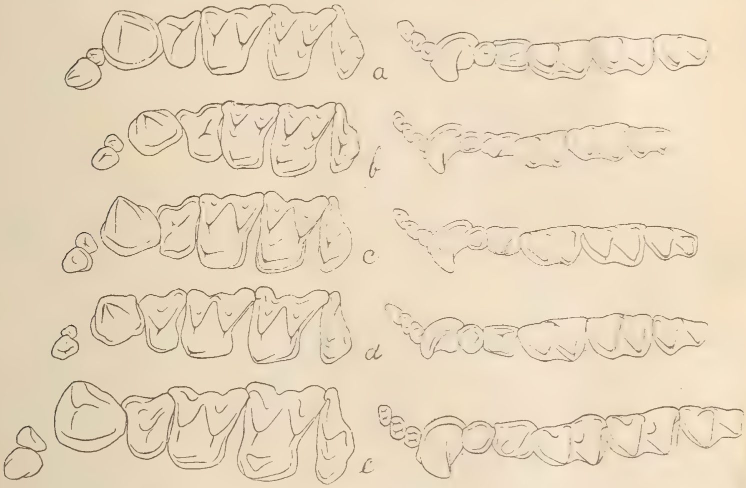


FIG. 26.—Teeth of (*a*) *Vespertilio fuscus*, (*b*) *V. bahamensis*, (*c*) *V. cubensis*, (*d*) *V. miradorensis*, and (*e*) *V. serotinus* (×5).

Ears.—Ears smaller than in typical *fuscus*, but of essentially the same shape, thus narrower than in *propinquus*. The ear membrane is thinner and more membranaceous than in true *fuscus*, in this respect resembling that of the other southern races.

Membranes and feet.—The membranes and feet are as in typical *fuscus*, allowance being made for the smaller size of *bahamensis*, and the difference in texture of the membranes common to all the southern races.

Fur and color.—The fur is shorter than in true *fuscus*, averaging only about 8 mm. in length on the back. It is distributed exactly as in the typical subspecies. So far as can be determined from specimens preserved in alcohol, the color is considerably darker and duller than in true *fuscus*.

Skull.—The skull of *Vespertilio fuscus bahamensis* is much smaller and more lightly built than that of typical *fuscus* (figs. 24*a* and 25*a*). The skull of a fully adult male measures: Occipito-nasal length, 16.5; zygomatic breadth, 11; mandible, 12.6. In form it differs from that of true *fuscus* in its narrower, deeper, more cylindric brain case and less sharply 'peaked' occiput.

Teeth.—The teeth, like the skull, are smaller than those of true *fuscus* (fig. 26*b*). In a fully adult male the upper tooth row (exclusive of incisors) measures 6.4 mm.; the mandibular tooth row, 7.8 mm. In form the teeth differ slightly from those of true *fuscus* in the greater breadth of the inner (lingual) side of the first and second upper molars.

Measurements.—See table, page 103.

Specimens examined.—Total number 90, all from the type locality.

General remarks.—*Vespertilio fuscus bahamensis* needs no comparison with typical *fuscus* or with *V. fuscus cubensis*, from both of which it differs widely in size. Its superficial resemblance to *V. fuscus propinquus* is closer. Unlike the latter, it has a very narrow muzzle.

VESPERTILIO FUSCUS ~~CUBENSIS (Gray~~).

1839. *Scotophilus cubensis* Gray, Ann. Nat. Hist., IV, p. 7.

1840. *Vespertilio dutertreus* Gervais, in Ramon de la Sagra's Hist. de l'Ile de Cuba, Mammifères, p. 6.

1892. *Vesperugo fuscus cubensis* Chapman, Bull. Am. Mus. Nat. Hist., IV, p. 316.

Type locality.—Cuba.

Geographic distribution.—Cuba.

General characters.—Externally similar to *Vespertilio fuscus miradorensis*, but slightly smaller in general size, and with much smaller ears. Skull about as large as in true *fuscus*, thus much smaller than in *miradorensis*.

Ears.—The ears are delicate and papery, like those of the other southern races. They are smaller than in either *fuscus* proper or *miradorensis*. In form they differ markedly from those of true *fuscus* in their general narrowness, and especially in their more pointed tips. The characters of the ears have already been described by Mr. Chapman.

Membranes.—In form the membranes do not differ from those of the other subspecies. In texture they agree with the southern forms.

Fur and color.—The fur is distributed exactly as in the other subspecies. In color the specimens, after five years' immersion in alcohol, are darker and redder, especially on the whole ventral surface, than any others that I have seen. They even surpass *V. fuscus miradorensis* in darkness and richness of color.

Skull.—The skull of *Vespertilio fuscus cubensis* is about the size of that of true *fuscus* or a little smaller, thus distinctly smaller than that of *V. fuscus miradorensis*, the form to which *cubensis* bears the closest superficial resemblance, and much larger than that of *bahamensis*, its nearest geographical ally. In form the skull is similar to that of true *fuscus* but the brain case is slightly less flattened. The sagittal crest is well developed as in the other large subspecies.

Teeth.—The teeth of *Vespertilio fuscus cubensis* (fig. 26 *c*) differ from those of true *fuscus* in the greater breadth of the inner (lingual) sides of the maxillary molars. These teeth are also distinctly shortened in their transverse diameter. These peculiarities are exaggerations of the conditions found in *miradorensis* and *bahamensis*.

Measurements.—See table below.

Specimens examined.—Total number, 11, from the following locality:

Cuba: Trinidad, 10[1]; ——, 1.

General remarks.—*Vespertilio fuscus cubensis* is a fairly well marked insular form apparently most closely related to *V. fuscus miradorensis* of southern Mexico. It differs much less from this large continental subspecies than from *V. fuscus bahamensis*, its nearest geographical ally.

Average measurements of subspecies of Vespertilio fuscus.

Subspecies.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
fuscus	Massachusetts: Cambridge	2	116	47.5	19.5	10.4	45	6.8	81	18	13.3	8.3
	New York: Sing Sing	10	113.9	44.3	19.1	9.7	45.3	7	80	19.5	12.7	8.3
	District of Columbia: Washington.	5	110.8	46.5	19.1	9.7	44.8	6.5	80.5	18.1	12.8	8
	Mississippi: Bay St. Louis	2	108.5	42	19.5	10	47	6.7	79.5	17.5	12.5	7.8
	California: Nicasio	10	113	47	19.7	9.6	46.4	6	82	17.8	12.7	8.1
	Lone Pine	5	108.6	46	19.6	9.2	44.8	6.1	79.4	17	12.4	8.1
miradorensis	Vera Cruz: Mirador	[2]1	......	57	....	10.6	50	8.3	....	....	....	8.3
	Jico	1 ♂	118	48	22	10	50	8	91	19.4	13	10
	Las Vigas	1 ♀	120	50	22	10	51	7	85	18	13.6	9
	Tlaxcala: Mt. Malinche	1 ♂	120	50	21.6	11.4	52	6.4	96	19	13	8.8
	Puebla: Tehuacan	2 ♀ ♀	119	50.5	20.7	9.8	50.5	7	90	19	13.3	9
	Guatemala: Zuñil	1 ♂	110	....	20	10.4	50	6.4	....	18.6	12	8
	Costa Rica: San José	1	118	49	22	10	52	6.8	93	20	13.6	9
propinquus	Guatemala: Sta. Ysabel	[2]1	105	45	18	10	40	9.5	....	15	11.4	6
	Nicaragua: Greytown	1 ♀	96	37	17	7.8	40	5	68	14	11	7.8
bahamensis	New Providence: Nassau	[2]1 ♂	103	44	18	8	42	6	77	16.8	11	8
	Nassau	10	101.7	42.6	17.9	8.6	42.7	6	74	15.6	11.3	7.6
cubensis	Cuba: Trinidad	10	110.7	48.5	19.9	9	48.4	6.6	86	16.7	12.6	8.4

---

[1] For the opportunity of examining these specimens I am indebted to Dr. J. A. Allen of the American Museum of Natural History.

[2] Type.

[NOTE.—The following species is not represented in any of the extensive collections of bats recently made in Mexico. As I have never seen the animal and hence can form no opinion as to the weight of its characters, I have not attempted to include it in the synopsis of the North American forms of *Vespertilio*. Dobson's description, based on an examination of the type, may be introduced here, however, as an aid to the recognition of the species.]

VESPERTILIO ALBIGULARIS (Peters).

1872. *Vesperus* (*Marsipolæmus*) *albigularis* Peters, Monatsber. K. Akad. Wiss., Berlin, p. 260.

1878. *Vesperugo albigularis* Dobson, Catal. Chiroptera Brit. Mus., p. 207.

"Ears very broad and broadly rounded off above; the lower half of the outer margin of the ear-conch broadly folded backwards, as in *V. noctula*, separated in front from the angle of the mouth by a wart, *but terminating below and internal to it under the lower jaw by a small internal prolongation;* tragus broad above, attaining its greatest width above the middle of the inner margin, which is slightly concave, narrowest opposite the base of the inner margin, a prominent triangular lobe at the base of the outer margin. Nostrils rather wide apart, opening sublaterally; muzzle broad and obtuse; crown of the head scarcely elevated above the face-line.

"Wings from the base of the toes; postcalcaneal lobe long and narrow; last caudal vertebra free.

"Fur dark brown above, the extreme tips hoary, as in *V. noctivagans*, paler beneath, the *chin and throat*, as far back as a line connecting the posterior margins of the ears, *pure white*.

"Upper inner incisors long and broad and slightly bifid at their extremities; outer incisors very short, shortly exceeding the cingulum of the inner ones in vertical extent; the single upper premolar close to the canine; lower incisors in the direction of the jaws; first lower premolar half the size of the second, which exceeds the molars in vertical extent.

"Length (of the type specimen, an adult ♂), head and body 2″.35 [59.7 mm], tail 1″.5 [38 mm], head 0″.7 [17.8 mm], ear 0″.65 × 0″.13 [16.5 mm × 3.3 mm], forearm 1″.65 [41.9 mm], thumb 0″.35 [8.9 mm], third finger 2″.75 [69.8 mm], fifth finger 2″ [50.8 mm], tibia 0″.6 [15.2 mm], foot 0″.35 [8.9 mm].

"*Hab.*—Mexico. Type in the collection of the Berlin Museum.

"This species may be at once distinguished from all other species of *Vespertilionidæ* by the very peculiar manner in which the outer margin of the ear-conch terminates under the jaw, which has caused the describer, Dr. Peters, to make it the type of a new subgenus, *Marsipolæmus*. In the prolongation of the ear conch, in the form of the tragus, and in dentition it resembles the African species of *Chalinolobus*."

General remarks.—This species is very different from any of those recently collected in Mexico, and is probably well worthy of subgeneric or even generic separation from *Vespertilio*. Its characters are so remarkable and Mexico has recently been so thoroughly explored that doubt is thrown on the accuracy of Peters' information concerning the type locality.

Genus LASIURUS Gray.

1831. *Lasiurus* Gray, Zoological Miscellany, No. 1, p. 38 (based on the American hairy-tailed bats).
1864. *Lasiurus* H. Allen, Monogr. N. Am. Bats, p. 14.
1870. *Atalapha* Peters, Monatsber. K. Akad. Wiss., Berlin, p. 907. (Not *Atalapha* Rafinesque, 1814.)
1878. *Atalapha* Dobson. Catal. Chiroptera Brit. Mus., p. 267. (Not *Atalapha* Rafinesque, 1814.)
1893. *Atalapha* H. Allen, Monogr. Bats N. Am., p. 141. (Not *Atalapha* Rafinesque. 1814.)

Type species.—Lasiurus borealis (Müller).

Geographic distribution of genus.—The whole of North America and South America, the West Indies, Sandwich Islands, and Galapagos Islands.

Generic characters.—Dental formula: $i, \frac{1\text{-}1}{3\text{-}3}$; $c, \frac{1\text{-}1}{1\text{-}1}$; $pm, \frac{2\text{-}2}{2\text{-}2}$; $m, \frac{3\text{-}3}{3\text{-}3} = 32$; upper incisor in contact with canine; a minute upper premolar at base of canine on inner (lingual) side; dental formula otherwise as in *Dasypterus*, *Nycticeius*, and *Rhogeëssa;* skull (figs. 28, 29, 31) broad, short and deep, very different in form from that of any other North American genus of *Vespertilionidæ* except *Dasypterus;* ear (fig. 27) broad, blunt, and rounded at tip, hairy on most of dorsal surface: dorsal surface of interfemoral membrane furred nearly to extreme edge: mammæ, 4.

The members of the genus *Lasiurus* are recognizable among North American bats by their thickly furred interfemoral membranes. Two distinct species are known to occur north of Panama; one of these is divisible into at least five well-marked geographic races.

KEY TO NORTH AMERICAN FORMS OF LASIURUS.

Size large (forearm more than 50 mm.) .... *cinereus* (p. 112)
Size small (forearm 36–44).
  Underside of wing membrane very sparsely haired along forearm. *mexicanus* (p. 111)
  Underside of wing membrane thickly furred immediately back of forearm.
    Ear small and with slightly developed external basal lobe .... *teliotis* (p. 110)
    Ear large and with well-developed external basal lobe.
      Color mahogany brown .... *seminolus* (p. 109)
      Color varying from deep rich cherry red through orange and yellow to light yellowish gray.
        Color deep rich cherry red, forearm 42–44 .... *pfeifferi* (p. 110)
        Color varying from yellowish gray to light red, forearm 36–43 .... *borealis* (p. 105)

LASIURUS BOREALIS (Müller). Red Bat.

1776. *Vespertilio borealis* Müller, Natursyst. Suppl., p. 21.
1777. *Vespertilio noveboracensis* Erxleben, Syst. Regni Anim., I, p. 155.
1781. *Vespertilio lasiurus* Schreber, Säugthiere. Abth. I. Taf. LXII B (published with Abth. IV Heft 4. See Sherborn, Proc. Zool. Soc. London, 1891, p. 589).
1785. *Vespertilio noveboracus* Boddaert, Elenchus Animalium, I, p. 71.
1785. *Vespertilio lasurus* Boddaert, Elenchus Animalium, I, p. 71.
1796. *Vespertilio rubellus* Palisot de Beauvois, Catal. Peale's Museum, p. 204.

1814. *Atalapha americana* Rafinesque, Précis des découv. somiol., p. 12 (nomen nudum).[1]
1815. *Vespertilio rubra* Ord, Guthrie's Geography, 2d Am. ed., II, p. 291.
1818. *Vespertilio tesselatus* Rafinesque, American Monthly Mag., III, p. 445.
1818. *Vespertilio monachus* Rafinesque, Am. Monthly Mag., III, p. 445.
1820. *Vespertilio rufus* Warden, Description des États-Unis de l'Amérique Septentrionale, V, p. 606.
1863. *Lasiurus noveboracensis* H. Allen, Monogr. N. Am. Bats, p. 15.
1870. *Lasiurus funebris* Fitzinger, Sitzungsber. k. Akad. Wissensch. Wien, LXII, p. 46.
1878. *Atalapha noveboracensis* Dobson, Catal. Chiroptera Brit. Mus., p. 269.
1893. *Atalapha noveboracensis* H. Allen, Monogr. Bats N. Am., p. 142.
1894. *Atalapha borealis* Rhoads, American Naturalist, XXVIII, p. 523.

Type locality.—New York.

Geographic distribution.—The typical form of *Lasiurus borealis* ranges through the Boreal, Transition, and Austral zones in eastern North America from Canada to Florida and Texas, west at least to Indian Territory and Colorado. Southern and western limits of range not known. Probably breeds throughout its known range.

General characters.—Size small (forearm, 38 to 43; longest finger, 78 to 88); forearm with no distinct tuft of fur near proximal end; color very variable, ranging from bright yellowish red or fawn color to yellowish gray; a whitish area in front of shoulder.

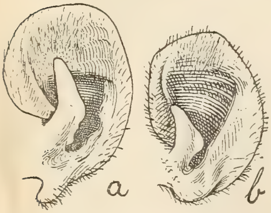


FIG. 27.—Ear of (*a*) *Lasiurus borealis* and (*b*) *L. teliotis* (×2).

Ears.—The ears of typical *Lasiurus borealis* (fig. 27*a*) when laid forward reach a little more than halfway from angle of mouth to nostril. The anterior border is strongly but irregularly convex from free point of anterior basal lobe to tip, a distance through which it forms almost a semicircle. The posterior border is slightly concave immediately below tip, then evenly convex to basal lobe. The convex portion of the outline of the posterior border forms the arc of a circle with considerably longer radius than that of the anterior border. Posterior basal lobe strongly developed and deeply notched on anterior border. Inner side of ear naked except for a few scattered hairs, which are especially numerous along anterior and posterior borders. Outer side densely furred throughout basal two-thirds, naked at tip.

Tragus triangular in general outline. Anterior border straight from base to slight concavity just below tip; posterior border straight from tip to widest point (opposite anterior base), where there is a strong angle, below which the margin is straight to slightly developed basal lobe.

---

[1] Rafinesque says: "J'ai observe cette espèce [*A. sicula* Raf.] en Sicile, elle diffère de l'*Atalapha americana* (*Vespertilio noveboracensis* Lin.), autre espèce du même genre, par ses deux premiers et son dernier caractère."

Membranes.—The flight membranes are attached at base of toes, the uropatagium at extreme tip of tail.

Feet.—The foot is small, less than half as long as tibia. Dorsal surface of toes thickly furred. Calcar about twice as long as foot and considerably shorter than free border of interfemoral membrane. It is slightly developed, indistinctly keeled, and seldom lobed at tip.

Fur and color.—The fur is everywhere full and soft. On middle of back it is about 7 mm. in length and on neck about 10 mm. It covers the basal two-thirds of dorsal side of ear, the whole dorsal side of the interfemoral membrane, and the dorsal side of the flight membrane to a line running from ankle to middle of humerus. There is a narrow strip of fur running along basal third of fifth metacarpal and a squarish clump at base of thumb. Near base of forearm (in position occupied by strip of fur in *L. cinereus*) there are numerous fine scattered hairs, which are so inconspicuous as readily to escape notice. On the ventral surface the fur reaches about to middle of uropatagium and on flight membranes to line joining knee and elbow. Beyond elbow a sparse growth of hairs covering an area 10 mm. or more in width extends along forearm to bases of fingers, where it becomes much more dense. The antebrachial membrane is covered with a sparse coating of hairs on the ventral surface.

In color typical *Lasiurus borealis* varies very extensively, but never shows the mahogany brown of *seminolus* or the intense red of the tropical races. Red specimens are rufous red throughout (the exact shade somewhere between rufous and burnt sienna), paler and more fawn-colored on the belly, the hairs of the back usually with distinct grayish tips, those on the throat and chest tipped with whitish. A yellowish white patch in front of each shoulder. Frequently the white on chest tends to connect the shoulder patches by a whitish collar. The individual hairs on the back are blackish at base, then light rufous to the narrow subapical band which gives the characteristic color to the back, and, finally, grayish white at extreme tips. Gray specimens are yellowish gray on the back and buffy on the belly. The red usually persists as a faint salmon suffusion.

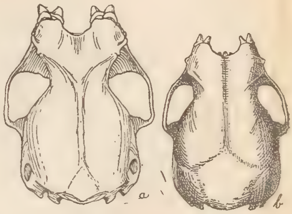


FIG. 28.—Top view of skull of (*a*) *Lasiurus borealis* and (*b*) *L. teliotis* (×2).

Skull.—The skull of typical *Lasiurus borealis* (figs. 28 *a*, 29 *b*) has the broad rostrum and flaring zygomata of *L. cinereus*. The dorsal profile of the skull is nearly straight from external nares to highest point of occiput. The skull of an adult female from Washington, D. C., measures: Greatest length, 13.8; zygomatic breadth, 10.2; breadth of rostrum at posterior edge of large premolar, 6; mandible, 10; upper tooth row, 5.4; lower tooth row, 6.4.

Teeth.—The teeth (fig. 30 *b*) are large, the upper molars broad on the inner (lingual) side, and the lower molars wide in their transverse diameter.

Measurements.—See table, page 115.

Specimens examined.—Total number, 387, from the following localities:

Alabama: Mobile Bay, 3; Greensboro, 9 (2 skins, Merriam coll.).
Arkansas: Fort Smith, 1.
District of Columbia: Washington, 20 (6 skins).
Florida: Old Town, 1 (skin, Miller coll.); St. Marys, 1.
Georgia: Riceboro, 8.
Illinois: Mount Carmel, 1 (skin); Olney, 3; Warsaw, 2; West Northfield, 1 (skin).
Indian Territory: Hartshorne, 1 (skin); Redland, 3.
Kansas: Cedar Vale, 1.
Kentucky: Hickman, 2.
Louisiana: Lafayette, 1; New Orleans, 2; Pineville, 1; Shreveport, 1.
Massachusetts: Nantucket, 1.
Mississippi: Hancock County, 1 (skin, Miller coll.); Washington, 10.
Missouri: Golden City, 1; Marble Cave, Stone County, 1.
New York: Greene, 1; Hartford, 1 (skin); Oyster Bay, 1 (skin); Sing Sing, 86.
North Carolina: Fort Macon, 1 (skin); Magnetic City, 1 (skin); Roan Mountain, 1 (skin).
Oklahoma: Ponca, 2.
Ontario: North Bay, 2 (Miller coll.); Toronto, 1 (skin).
Pennsylvania: Bainbridge, 1; Carlisle, 1 (skin); Kenneth Square, Chester County, 1.
South Carolina: Mount Pleasant (near Charleston), 7 (skins, Miller coll.)
Tamaulipas: Matamoras, 2.
Tennessee: Alexandria, 1; Arlington, 2; Big Sandy, 11; Clarksville, 1; Danville, 1.
Texas: Arthur, 3; Brownsville, 158 (3 skins); Clarksville, 1; Corpus Christi, 2; Fort Clark, 1; Nueces Bay, 1; Paris, 3; Waco, 1 (skin, Miller coll.); Wichita Falls, 1.
Virginia: Amelia Court-House, 1; Berryville, 1 (skin); Dismal Swamp, 2; Gainesville, 1.

General remarks.—Typical *Lasiurus borealis* presents a wide range of individual variation, but may always be distinguished from the other subspecies by fairly constant characters. It never shows the mahogany brown coloring of *L. borealis seminolus* and seldom approaches the brilliant cherry red of *L. borealis pfeifferi.* From *L. borealis teliotis* it differs in its larger ear with well-developed, strongly-notched external basal lobe.

Specimens from Brownsville, Tex., where the animal breeds, are slightly smaller than those from New York, and the ear is proportionally shorter (see table of measurements, p. 115). In this respect they are intermediate between true *borealis* and *teliotis*, though the ear is formed exactly as in the typical subspecies. Specimens from Oklahoma and Indian Territory, on the other hand, are indistinguishable from northeastern specimens.

LASIURUS BOREALIS SEMINOLUS (Rhoads).

1895. *Atalapha borealis seminola* Rhoads, Proc. Acad. Nat. Sci. Phila., p. 32.

Type locality.—Tarpon Springs, Fla.

Geographic distribution.—Lower Austral and Tropical zones from South Carolina to southern Texas.

General characters.—In size and proportions similar to typical *Lasiurus borealis;* general color mahogany brown, slightly frosted with grayish.

Ears, membranes, feet, and distribution of fur.—In all external characters except color *Lasiurus borealis seminolus* agrees with typical *borealis.*

Color.—General color rich mahogany brown throughout, the back (especially between the shoulders) slightly frosted with gray and the throat and chest varied with whitish. A distinct whitish area in front of shoulder as in true *borealis.* Muzzle, backs of ears, and fur bordering forearm, yellowish brown. Clump of fur at base of thumb whitish or yellowish. On middle of back the fur is about 12 mm. in length. In this region the colors on the individual hairs are arranged in four bands as follows: Basal band deep blackish plumbeous (this band usually broader than in true *borealis*), middle band light gray, subapical band rich mahogany, extreme tip grayish white.

Color variation in *Lasiurus borealis seminolus* is much less than in typical *borealis*, and is chiefly noticeable in the amount of red in the mahogany brown, in the amount of white on the throat and chest, and in the shade of gray in the broad middle band on the hairs of the back. This is often strongly suffused with yellowish.

Skull and teeth.—As in typical *borealis.*

Measurements.—See table, page 115.

Specimens examined.—Total number, 19, from the following localities:

Florida: Old Town, 3 (skins, Miller coll.); Lake Harney, 2.
Georgia: Nashville, 1.
Louisiana: New Orleans, 5.
Mississippi: Bay St. Louis, 3.
South Carolina: Mount Pleasant (near Charleston), 4.
Texas: Brownsville, 1.

General remarks.—*Lasiurus borealis seminolus* appears to be a well-marked subspecies confined to the Austroriparian fauna. The single specimen taken at Brownsville, Texas (No. 59976, U. S. National Museum) was killed on September 8, 1891, and may have been a migrant. No intermediates between *seminolus* and true *borealis* has yet come to light, but the perfect agreement of the two forms in all charaters except color makes me unwilling to recognize them as species. The possibility that *seminolus* and true *borealis* are dichromatic phases of one species lacks weight on account of the total absence of intermediate specimens, and also from the fact that both forms have not yet been found breeding at any one locality.

LASIURUS BOREALIS PFEIFFERI (Gundlach).

1861. *Atalapha pfeifferi* Gundlach, Monatsber. K. Preuss Akad. Wiss., Berlin, p. 152.
1878. *Atalapha noveboracensis* var. *β* (*Atalapha pfeifferi*) Dobson, Catal. Chiroptera Brit. Mus., p. 271.
1892. *Atalapha noveboracensis pfeifferi* Chapman, Bull. Am. Mus. Nat. Hist., IV, p. 316.

Type locality.—Cuba.

Geographic distribution.—Cuba. Jamaica? Bahamas?

General characters.—Slightly larger than typical *Lasiurus borealis*, but similar in proportions; color brighter and more intense.

Ears, membranes, feet, and distribution of fur.—As in the typical subspecies.

Color.—I have seen no skins of the Cuban red bat, and am therefore unable to give a detailed description of the animal's color. The two specimens collected by Mr. Chapman in 1892 have now been in alcohol for five years. Hence their color furnishes no trustworthy basis for comparison with that of continental material. When compared with alcoholic specimens from the eastern United States they are appreciably brighter.

Measurements.—See table, page 115.

Specimens examined.—Two from Trinidad, Cuba (Am. Mus. Nat. Hist.).

A skull from Nassau, Bahamas (Miller coll.), and an imperfect skin from Spanishtown, Jamaica, may be referable to this race, but it is not possible to identify them with certainty.

General remarks.—*Lasiurus borealis pfeifferi* is a tolerably well-marked insular form, distinguished from typical *borealis* by its slightly larger size and brighter color.

LASIURUS BOREALIS TELIOTIS (H. Allen).

1891. *Atalapha teliotis* H. Allen, Proc. Am. Philos. Soc., XXIX, p. 1.
1893. *Atalapha teliotis* H. Allen, Monogr. Bats N. Am., p. 153.

Type locality.—Unknown, probably some part of California (type in U. S. National Museum).

Geographic distribution.—This form is known from a few localities in California and Lower California from the head of the Sacramento Valley south to Comondu.

General characters.—Slightly smaller than typical *Lasiurus borealis;* ear proportionally much shorter than in the typical subspecies, and with external basal lobe greatly reduced in size; color averaging brighter than in the typical form.

Ears.—The ear (fig. 27*b*) is similar in form to that of typical *borealis*, except that the tip is slightly narrower and the external basal lobe is reduced in size, indistinctly marked off from the rest of the ear, and scarcely, if at all, notched on its anterior border.

Membranes, feet, and distribution of fur.—The external form, with the exception of the size and shape of ears, is as in true *borealis*.

Color.—I have seen only four skins of the Californian red bat. In these the color is uniformly slightly darker and redder than in ordinary red specimens of true *borealis*. The difference is especially noticeable on the interfemoral membrane, rump, and lumbar region. One skin (♂) from Dulzura, Cal., almost lacks the grayish tips to the hairs on the back. Another (also ♂) taken at the same place on the same day (November 5, 1891) shows the gray tips very distinctly on the neck and fore part of the back.

Skull.—The skull of *Lasiurus borealis teliotis* (figs. 28 *b*, 29 *a*) is distinguishable from that of typical *borealis* by its smaller size, narrower rostrum, and less flaring zygomata. That of an adult male from Dulzura, Cal., measures: Greatest length, 12.4; zygomatic breadth, 9; breadth of rostrum at posterior edge of large premolar, 5.2; upper tooth row, 4.6. The mandible of this specimen is lost. That of another adult male from the same locality measures: Length, 9; lower tooth row, 5.4.

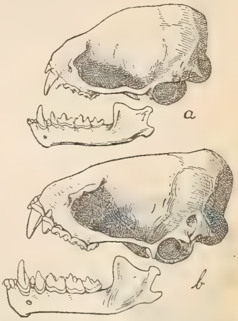


FIG. 29.—Side view of skull of (*a*) *Lasiurus teliotis* and (*b*) *L. borealis* (×2).

Teeth.—The teeth are smaller than in the typical subspecies, the upper molars are narrower on the inner (lingual) side, and the mandibular teeth are narrower in their transverse diameter (fig. 30 *a*.)

Measurements.—See table, page 115.

Specimens examined.—Total number, 10, from the following localities:

California: Exact locality unknown, 1 (type); Bakersfield, 1; Berryessa, Santa Clara County, 1 (skin); Dulzura, 2 (skins, Miller coll.); Fresno, 1; Santa Ysabel, San Diego County, 1; Tehama, 1; Three Rivers, 1.
Lower California: Comondu, 1 (skin).

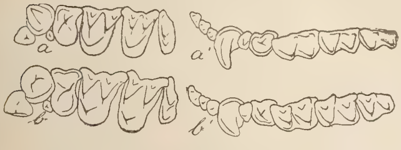


FIG. 30.—Teeth of (*a*) *Lasiurus teliotis* and (*b*) *L. borealis* (×5).

General remarks.—*Lasiurus borealis teliotis* is readily distinguishable from typical *borealis* by its smaller ear, with less developed and entire external basal lobe, smaller skull, with narrower rostrum, and weaker dentition. From *L. borealis mexicanus* it differs in completely furred dorsum of interfemoral membrane and more hairy under side of wing.

LASIURUS BOREALIS MEXICANUS (Saussure).

1861. *Atalapha mexicana* Saussure, Revue et Mag. de Zool., 2e sér., XIII, p. 97, Mars., 1861 (southern Mexico).
1871. *Atalapha frantzii* Peters, Monatsber. K. Preuss. Akad. Wiss., Berlin (1870), p. 908, 1871 (Costa Rica).
1878. *Atalapha noveboracensis* var. α (*Atalapha frantzii*) Dobson, Catal. Chiroptera Brit. Mus., p. 271.

Type locality.—Not stated, but without doubt in some one of the States of southern Mexico, probably Vera Cruz, Puebla, or Oaxaca.

Geographic distribution.—Central America and southern Mexico. Limits of range unknown.

General characters.—Apparently most like *Lasiurus borealis teliotis*, but feet, interfemoral membrane, and under side of wings much less hairy.

Ears.—In dried specimens the ears appear to be essentially as in *L. borealis teliotis*, though the external basal lobe may be slightly more developed.

Membranes and feet.—These show no distinctive characters.

Fur and color.—On the body the fur shows no peculiarities as compared with the other subspecies. On the interfemoral membrane it extends thickly to about the middle, then becomes more sparse, and finally disappears, leaving the edge of the membrane bare. The backs of the feet are scarcely furred. On the under side of the wings, the area behind the forearm which is densely furred in the other subspecies, is merely sprinkled with inconspicuous hairs: these are, however, more dense at the bases of the fingers. The antebrachial membrane is also very sparsely furred.

Color as in *L. borealis teliotis.*

Measurements.—See table, page 115.

Specimens examined.—Total number, 8, from the following localities:

Jalisco: ———, 6.
Tehuantepec: Guichicovi, 1 (skin).
Vera Cruz: Penuela (near Cordova), 1 (skin).

General remarks.—From the unsatisfactory material at my disposal it appears that *Lasiurus borealis mexicanus* is a well-marked race, most like *teliotis*, but differing from this, as well as from all the other known subspecies, in the restricted peripheral distribution of the fur.

LASIURUS CINEREUS (Beauvois). Hoary bat.

1796. *Vespertilio linereus* Palisot de Beauvois, Catal. Peale's Museum, Philadelphia, p. 14. (Obvious misprint for *cinereus.*)
1823. *Vespertilio pruinosus* Say, Long's Exped. to Rocky Mts., I, p. 167 (footnote).
1864. *Lasiurus cinereus* H. Allen, Monogr. N. Am. Bats, p. 21.
1878. *Atalapha cinerea* Dobson, Catal. Chiroptera Brit. Mus., p. 272.
1893. *Atalapha cinerea* H. Allen, Monogr. Bats N. Am., p. 155.

Type locality.—Philadelphia, Pennsylvania.

Geographic distribution.—Boreal North America from Atlantic to Pacific. The hoary bat breeds within the Boreal zone, but in autumn and winter it migrates south to the southern border of the United States and probably much farther.

General characters.—Size, large (forearm, over 50 mm.); prevailing color, gray; ears with black rims; forearm with distinct patch of fur near base.

Ears.—The ears of *Lasiurus cinereus* are in general similar to those of *L. borealis*, but are broader in proportion to their length (see table of measurements, p. 115). The external basal lobe is less developed than in *borealis* and without trace of notch on anterior border. Margin of ear membrane dark brown or blackish. Outer side of ear densely furred to a little beyond middle. Inner side with conspicuous patch of yellowish hairs above and in front of middle and a border of similar hairs along lower part of anterior edge.

Tragus shaped as in *L. borealis*, covered with sparse coating of hairs on outer side.

Membranes.—In form and attachment the membranes are as in *L. borealis.*

Feet.—Foot about half as long as tibia; dorsal side thickly furred. Calcar twice as long as foot and slightly shorter than free border of interfemoral membrane. It is distinctly though narrowly keeled on posterior edge, and usually lobed at tip. The terminal lobe is very variable, and may be well developed on one side and absent on the other.

Fur and color.—The fur is distributed much as in *L. borealis.* As in that species, it is distinctly longer on neck than on back, thus forming a ruff. On the neck it averages about 15 mm. in length, on the back 11 mm. General color, a mixture of light yellowish brown, deep umber brown, and white, the yellowish brown clear and unmixed on throat, head, and under side of membranes, the umber brown predominating on back and dorsal surface of interfemoral membrane, where, however, the hairs are mostly tipped with silvery white, sometimes to so great an extent as nearly to conceal the dark tints beneath. Lips, chin, and cheeks sprinkled with short blackish hairs. Ventral surface with white predominating on belly, between which and yellow of throat is a band in which the umber brown is more conspicuous than elsewhere on the under parts. Tufts of fur at bases of thumb, fifth finger, and forearm, light yellowish brown, like fur on under side of wing membranes. On middle of back the individual hairs are colored as follows: Deep plumbeous at base; light yellowish brown (shading toward umber distally) through middle half; umber brown subapically; silvery white at tip.

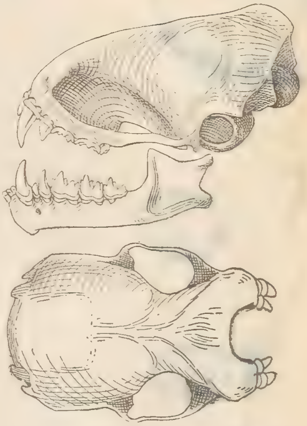


FIG. 31.—Skull of *Lasiurus cinereus* (×2).

Color variation is considerable, but never enough to obscure the characters of the species. It appears to be wholly independent of locality, as skins from such widely separated localities as Minnesota and southern California are practically indistinguishable.

One skin from the Santee River, South Carolina, has the dusky tints throughout the pelage so intensified and extended as to suggest melanism. Another from Eureka, California, is in a similar phase, though not so extreme.

Skull.—The skull (fig. 31) resembles that of *Dasypterus intermedius* and *Lasiurus borealis*, but is intermediate between the two in size. The rostrum is broad and short and the zygomatic arches broadly flaring. The skull of an adult female from Santa Ysabel, California, measures: Greatest length, 16.4; zygomatic breadth, 12; breadth of rostrum at posterior border of large premolar, 8; mandible, 12.6; upper-tooth row, 6.4; lower-tooth row, 8. That of an adult female from Fort Snelling, Minnesota, measures: Greatest length, 17; zygomatic breadth, 12; breadth of rostrum at posterior edge of large premolar, 8; mandible, 13.6; upper-tooth row, 7; lower-tooth row, 8.

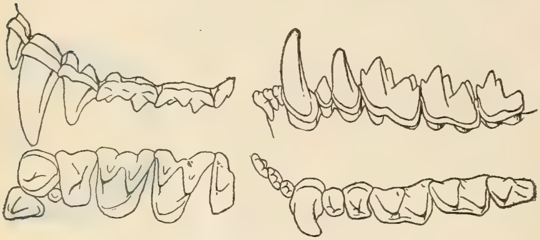


FIG. 32.—Teeth of *Lasiurus cinereus* (×5).

Teeth.—The teeth of *Lasiurus cinereus* (fig. 32) are large and strong, but the minute upper premolar is proportionally smaller than in *L. borealis*.

Measurements.—See table, page 115.

Specimens examined.—Total number, 56, from the following localities:

Alabama: Mobile Bay, 1.
Alberta: Eight miles NW. of Red Deer, 1 (skin, Miller coll.).
Arizona: Tempe, Maricopa County, 1.
California: Berryessa, Santa Clara County, 1; Cloverdale, 1; Eureka, 1 (skin); Kern River, 1; Monterey, 1; Nicasio, 1; Panamint Mountains, 2; Santa Ysabel, 1 (skin).
Chihuahua: San Luis Mountains, 1.
Colorado: Larimer County, 3 (skins, Miller coll.).
District of Columbia: Washington, 1.
Georgia: Savannah River, 1.
Illinois: Warsaw, 1.
Kansas: Little Blue River, 1; North Falls, 1.
Louisiana: Pineville, 1.
Maryland: Laurel, 1.
Massachusetts: North Truro, 6 (skins, Miller coll.).
Minnesota: Fort Snelling, 1.
Nebraska: Fort Pierre, 1; Fort Union, 2; Loup Fork, 1.
Nevada: Vegas Valley, 1.
New Mexico: Dog Spring, Grant County, 2; Doña Ana, 1.
New York: Westville, Long Island, 1; Locust Grove, 4.
Nova Scotia: Halifax, 1.
Tamaulipas: Matamoras, 1.
Texas: Brownsville, 9 (1 skin, Miller coll.).
Washington: Almota, 1; Fort Walla Walla, 1.

Average measurements of North American forms of Lasiurus.

Name.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
borealis	Ontario: North Bay	2♂♂	106	47.5	19.5	7.2	39	6.7	79.5	11.8	11.4	6.5
	New York: Sing Sing	10	110.4	50.9	19.6	7.8	39.7	7	81.7	11.9	11	7
	District of Columbia: Washington.	4	103	47.5	19.2	7.4	38.5	6.3	79.3	11.2	10.1	6.5
	Mississippi: Washington	10	105.6	49.1	19.2	7.4	40.1	7.3	80.4	11.8	10.1	6.7
	Texas: Brownsville	10	108.9	52.7	18.6	7.9	40.6	6.4	82.8	10.5	9.8	6.1
seminolus	South Carolina: Charleston.	2♂♂	100	46	19	6.9	40	7	81	12.7	10.7	6.9
	Florida: Lake Harney	2♂♂	97.5	45	19.3	7	40	7	79	11.3	10	6.5
	Mississippi: Bay St. Louis	3♀♀	104.3	50	19.3	7.6	40.2	7.4	83	12	11	6.5
	Texas: Brownsville	1♀	115	54	20	9	42	7	87	12.6	11.4	7
pfeifferi	Cuba: Trinidad	2♂♂	106.5	50.5	21.8	7	44	6.8	89.5	12.5	10.7	6.8
teliotis	California: ? (type)	1	......	....	20	6.6	39	7	79	9	7.6	5.4
	Three Rivers	1♂	96	47	....	8	37	6.6	74	9.8	9.8	6.4
	Tehama	1♂	107	57	20	8	39	6.4	82	9.4	9.6	6
	Bakersfield	1♀	100	45	19.6	8.6	40	7	76	10	9	6
mexicanus	Jalisco	6	113.3	57	20.2	8.1	41.2	7.4	86.5	13	10.2	6.5
cinereus	New York: Locust Grove	4	134.5	57.5	23.2	10	50.2	10.6	107	18	17.2	9.5
	California: Panamint Mts.	2♀♀	136	58.5	23.5	9	54	10	109	17.5	17.7	9
	Cloverdale	1♂	130	52	23	10	46	10.4	101	17	15	9
	Monterey	1♂	138	57	24	9	55	10	110	17	16	9
	Kern River	1♂	140	58	23	9	51	10	103	18	17.6	9

Genus DASYPTERUS Peters.

1864. *Lasiurus* H. Allen, Monogr. N. Am. Bats, p. 25 (part).
1871. *Dasypterus* Peters, Monatsber. K. Akad. Wiss., Berlin (1870), p. 912 (subgenus).
1878. *Atalapha* Dobson, Catal. Chiroptera Brit. Mus., p. 267. (Part—not *Atalapha* Rafinesque, 1814.)
1893. *Dasypterus* H. Allen, Monogr. Bats N. Am., p. 137 (genus).

Type species.—Dasypterus intermedius H. Allen.

Geographic distribution of type species.—Gulf States and northeastern Mexico.

Geographic distribution of genus.—The range of the genus is the same as that of the only known species.

Generic characters.—Dental formula:

$$i, \frac{1-1}{3-3}; \ c, \frac{1-1}{1-1}; \ pm, \frac{1-1}{2-2}; \ m, \frac{3-3}{3-3} = 30;$$

upper incisor in contact with canine; skull (fig. 33) easily distinguishable from that of any other American genus of *Vespertilionidæ*, except *Lasiurus*, by its extreme shortness, depth, and breadth; ear considerably higher than broad, somewhat tapering at tip, naked on half of dorsal surface; dorsal surface of interfemoral membrane furred on basal half only; mammæ, 4.

General remarks.—Without seeing the South American species originally associated with *D. intermedius* by Peters, it is impossible to determine whether these belong in the genus as now understood.

DASYPTERUS INTERMEDIUS H. Allen.

1863. *Lasiurus intermedius* H. Allen. Proc. Acad. Nat. Sci. Phila. (1862), p. 146.
1864. *Lasiurus intermedius* H. Allen, Monogr. N. A. Bats, p. 25.
1878. *Atalapha intermedia* Dobson, Catal. Chiroptera Brit. Mus., p. 274.
1893. *Dasypterus intermedius* H. Allen, Monogr. Bats N. Am., p. 137.

Type locality.—Matamoras, Tamaulipas, Mexico.

Geographic distribution.—Gulf States and northeastern Mexico.

General characters.—Size, large (forearm, 45–56); color, light brown.

Ears.—The ears are short, reaching barely to nostril when laid forward. The dorsal surface is densely furred on basal half, but otherwise the ear is naked except for a sprinkling of hairs on inner side, especially along anterior edge. Beginning at lower edge of basal lobe the anterior margin is first strongly convex, then nearly straight for a distance of about 6 mm., then abruptly convex (or even angular), after which it continues nearly straight to narrowly rounded off tip. Posterior border slightly concave immediately below tip, then gently and evenly convex to notch above posterior basal lobe. Posterior basal lobe well developed, slightly notched on lower side, and joining face about 5 mm. behind angle of mouth.

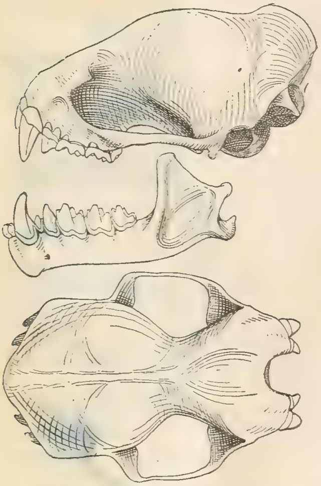


FIG. 33.—Skull of *Dasypterus intermedius* (×2.)

Tragus blunt and bent forward, anterior border nearly straight to slight concavity just below tip. Posterior border convex immediately below tip, then straight to point opposite anterior base. Here a sharp angle is formed, below which the margin is irregularly crenulated to base.

Feet.—The foot is moderate in size, a little less than half as long as tibia. Calcar slightly shorter than tibia, very indistinctly keeled and terminating obscurely or in an ill-defined lobe.

Membranes.—Membranes thick and leathery. Wing membrane attached at base of toes, uropatagium near tip of last caudal vertebra. Free border of uropatagium slightly longer than calcar.

Fur and color.—The fur is full and soft. On the middle of the back it is about 12 mm. in length. The fur of the back extends on basal half of outer side of ear, basal half of dorsal surface of interfemoral membrane, and base of wing membranes. On the latter it occupies a strip about 10 mm. in width. There is a slight tuft of hair at the base of the thumb, and in many specimens a faintly indicated tuft near proximal end of forearm. On the ventral surface the fur barely reaches the uropatagium except along the basal fourth of tail. A thin coating of fur occupies the under side of the wing membrane to a line joining elbow and knee. Beyond this it extends in a strip about 10 mm. wide along posterior edge of forearm to bases of fingers. The greater part of the propatagium is thinly furred.

Color light yellowish brown of variable shade, the hairs throughout the body with narrow dark plumbeous bases and those of the back with faintly dusky tips. The general effect is suggestive of the color of *Pipistrellus subflavus*.

Skull and teeth.—The skull (fig. 33) and teeth (fig. 34) have been sufficiently described under generic characters. The skull of an adult female from Brownsville, Tex. (No. 52540, U. S. National Museum), measures: Greatest length, 19.6; zygomatic breadth, 15; breadth of rostrum at posterior edge of premolar, 9; mandible, 15; upper tooth row, 8; lower tooth row, 9. The skull of an adult male from Houma, La., measures: Greatest length, 18; zygomatic breadth, 13; breadth of rostrum at posterior edge of premolar, 8; mandible, 14; upper tooth row, 7; lower tooth row, 8.6.

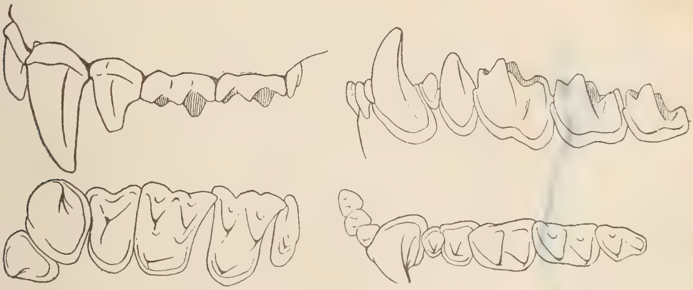


FIG. 34.—Teeth of *Dasypterus intermedius* (×5).

Measurements.—Average measurements of 18 specimens of *Dasypterus intermedius* from five localities are given in the following table:

Average measurements of 18 specimens of Dasypterus intermedius from 5 localities.

Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
Texas: Brownsville	10 ♀ ♀	145	65.9	24.9	10	55	8.9	111	18.8	14.4	8.8
Louisiana: Lafayette	2 ♀ ♀	126.5	52	20	8.7	48	7	96	18.5	15.5	9.3
Houma	2 ♂ ♂	130	61	18.9	9	46	6	95.5	18	15	9.4
Florida: Old Town	3	127	63.5	20	9	45.5	......	......	......	......	......
Mullet Lake	1 ♂	120	54	18	8	47	7	95	17	14	8

Specimens examined.—Total number 72, from the following localities:

Florida: Davenport, 1 (skin); Mullet Lake, 1; Old Town, 3.
Louisiana: Lafayette, 2; Houma, 2 (1 skin).
Mississippi: Hancock County, 1 (skin).
Tamaulipas: Matamoras, 3 (2 skeletons).
Texas: Brownsville, 57 (2 skins); Padre Island, 1; Cameron County, 1.

General remarks.—Aside from its generic characters *Dasypterus intermedius* is distinguishable among North American bats by its large size, small ears, and yellowish brown color.

Specimens from Louisiana, Mississippi, and Florida average distinctly smaller than those from Brownsville, Tex. (which are essentially topotypes). More extensive material than that now available may show the necessity of recognizing two subspecies, a larger Tamaulipan (typical) form, and a smaller Austroriparian form.

Genus NYCTICEIUS Rafinesque.

1819. *Nycticeius* Rafinesque, Journ. de Physique, LXXXVIII, June, 1819, p. 417.
1827. *Nycticeus* Lesson, Man. de Mamm., p. 98.
1827. *Nycticejus* Temminck, Monographies de Mamm., I, p. xviii.
1830. *Nycticeyx* Wagler, Natürl. System der Amphibien, p. 13.
1831. *Nycticea* Le Conte, McMurtrie's Cuvier, Animal Kingdom, p. 432.
1864. *Nycticejus* H. Allen, Monogr. N. Am. Bats, p. 11.
1878. *Nycticejus* Dobson, Catal. Chiroptera Brit. Mus., p. 266.
1893. *Nycticejus* H. Allen, Monogr. Bats N. Am., p. 131.

Type species.—*Nycticeius humeralis* Rafinesque.

Geographic distribution of type species.—Austral zones in the Eastern United States.

Geographic distribution of genus.—Austral zones in the Eastern United States. Cuba.

Generic characters.—Dental formula:

$$i, \frac{1-1}{3-3}; \; c, \frac{1-1}{1-1}; \; pm, \frac{1-1}{2-2}; \; m, \frac{3-3}{3-3} = 30;$$

upper incisor distinctly separated from canine; lower incisors scarcely crowded; outer lower incisor tricuspidate and not smaller than others; skull low and narrow; uropatagium furred at extreme base only; tragus blunt and bent forward; tip of tail free from membrane; mammæ, 2.

The genus *Nycticeius* as thus defined is peculiar to America, where it is represented by one species. It differs in dental formula from all other genera of American *Vespertilionidæ* except *Dasypterus* and *Rhogeëssa*. From the former it is distinguishable by its differently shaped skull, wide space between upper incisor and canine, and essentially naked uropatagium. From *Rhogeëssa* it is separated by details in the structure of teeth and skull, as well as by external characters.

NYCTICEIUS HUMERALIS Rafinesque. Rafinesque's Bat.

1818. *Vespertilio humeralis* Rafinesque, American Monthly Mag., III, p. 445.
1819. *Nycticeius humeralis* Rafinesque, Journ. de Physique, LXXXVIII, p. 417.
1831. *Nycticea crepuscularis* Le Conte, McMurtrie's Cuvier, Animal Kingdom, I, p. 432.

1864. *Nycticejus crepuscularis* H. Allen, Monogr. N. Am. Bats, p. 11.
1878. *Nycticejus crepuscularis* Dobson, Catal. Chiroptera Brit. Mus., p. 266.
1891. *Nycticejus humeralis* Thomas, Ann. & Mag. Nat. Hist., 6th ser., VII, p. 528.
1893. *Nycticejus humeralis* H. Allen, Monogr. Bats, N. Am., p. 132.

Type locality.—Kentucky.

Geographic distribution.—Austral zones in the eastern United States west to Arkansas and southern Texas.

General characters.—Size, medium (total length, 88 to 95; forearm, 34 to 38); color, dull brownish, slightly paler beneath.

Ears.—The ears are small and for their size remarkably thick and leathery. They are naked throughout except at extreme base above. Lower anterior half of inner surface with a few short scattered hairs. Anterior border strongly convex immediately above small but distinct anterior basal lobe, then very slightly convex to narrowly rounded off tip. Posterior border gently concave from immediately below tip to a little below middle, then convex to slightly developed external basal lobe.

Tragus short, broad, and blunt, bent slightly forward; posterior base with distinct lobule.

Membranes.—The membranes, like the ears, are thick and leathery. Wing membranes attached at base of toes, uropatagium at middle of terminal caudal vertebra.

Fur and color.—The fur is sparse and short, that on middle of back averaging about 6 mm. in length. It is closely confined to the body, barely reaching extreme base of uropatagium and flight membranes.

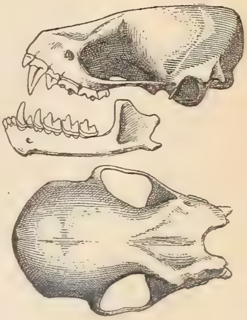


Fig. 35.—Skull of *Nycticeius humeralis* (×2).

Color dull umber brown above, paler below, the fur everywhere plumbeous at extreme base, but the dark basal color less well defined than in other species with which *Nycticeius* is found associated. The exact shade varies slightly, but is usually burnt umber or mummy brown on the back and raw umber or hair brown on the belly. One skin from Hickman County, Tenn. (No. 30637, U. S. National Museum), is dark sepia above, broccoli brown below.

Skull.—The skull (fig. 35) is short, broad, and low. That of an adult female from Sans Souci, N. C. (No. 43037, U. S. National Museum), measures 14 mm. in greatest length and 10 mm. in zygomatic breadth; greatest length of mandible, 10.6. Dorsal profile nearly straight from external nares to occiput, but slightly convex over front part of brain case. Occiput never developing strongly marked ridges. Length of bony palate behind molars (exclusive of central spine), about half width of interpterygoid fossa.

Teeth.—The teeth (fig. 36) are not so large as might be expected from the massiveness of the skull. Upper tooth row of adult female from Sans Souci, N. C., 6; lower, 6.8. Upper incisor close to canine, but separated from it by a space less than half as great as the diameter of the incisor. Upper molars much narrower on the inner side than on the outer side. Outer lower incisor with transverse diameter of crown slightly greater than that of second or third.

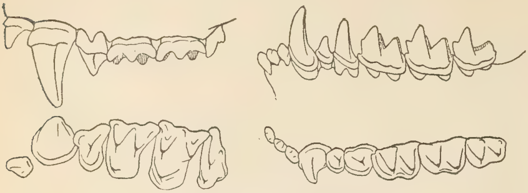


FIG. 36.—Teeth of *Nycticeius humeralis* (×5).

Measurements.—In the following table average measurements are given of 35 specimens of *Nycticeius humeralis* from the United States, and for comparison, Gundlach's measurements of a dry specimen of *N. humeralis cubanus*.

Average measurements of 36 specimens of Nycticeius.

Name.	Locality.	Number of specimens.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
humeralis	Pennsylvania: Carlisle	10	93.5	36.9	13.8	6.7	36.2	5.4	64.5	13.9	10	6.1
	Virginia: Dismal Swamp.....	5	91.4	35.8	13.4	7.7	35.8	5.6	63.4	13.5	10.5	6.2
	Tennessee: Big Sandy........	10	92.2	36.3	13.7	7.3	34.3	5.5	63.4	13.1	9.9	5.9
	Texas: Brownsville	10	92.3	37.2	13.6	7.2	36.4	5.3	65.2	12.7	8.8	5.1
cubanus	Cuba	1	....	29	11	6.7	30	5.5	55	....	....	....

Specimens examined.—Total number 154, from the following localities:

Arkansas: Fort Smith, 5.
District of Columbia: Washington, 2.
Florida: Titusville, 1; Chattahoochee, 1.
Georgia: Riceboro, 3.
Indian Territory: Redland, 4.
Kentucky: Hickman, 7.
Louisiana: Mer Rouge, 19; Pineville, 1.
Mississippi: Bay St. Louis, 17; Washington, 2.
North Carolina: Bertie County, 9; Sans Souci, 4 (skins).
Pennsylvania: Carlisle, 12.
Tamaulipas: Matamoras, 1.
Tennessee: Big Sandy, 13; Danville, 2; Warner, 1; Arlington, 4; Hickman County, 1 (skin).
Texas: Brownsville, 32; Paris, 3; Arthur, 1; Lomita Ranch, 2; Hidalgo, 1.
Virginia: Dismal Swamp, 5; near Riverton, 1 (skin, Miller coll.).

NYCTICEIUS HUMERALIS CUBANUS (Gundlach).

1861 *Vesperus cubanus* Gundlach, Monatsber. K. Preuss. Akad. Wiss., Berlin, p. 150.
1877. *Nycticeius cubanus*, Gundlach, Contribucion á la Mamalogia Cubana, p. 33.

Type locality.—Cuba.

Geographic distribution.—Cuba.

Characters.—I have not seen specimens of *Nycticeius* from Cuba, but Gundlach's careful description of the animal leaves no doubt that it is distinct from the form occurring on the mainland. It is distinguished from the latter by smaller size and apparently also by paler color. A translation of Gundlach's second and more perfect account of the animal is as follows: "Pelage above light tawny (the fur blackish at base), beneath pale reddish tawny (the base of the fur likewise blackish). Face and flight membranes blackish brown. The nose appears somewhat divided by the projecting nostrils; between the nose and the eyes there is on each side a protuberance with bristly hairs. Ears oval, lengthened (8 mm. high in front). The anterior base rounded and spreading outward; the posterior at the angle of the mouth forms a semicircle. This semicircle, which bends inward to the tragus, forms another rounded enlargement. Tragus oblong, scarcely narrowed throughout, somewhat bent in the form of a sickle forward and provided with a tooth-shaped lobule at the base of the exterior border. Nails tawny.

"The measurements of a dry specimen are as follows: Width between extremities of wing, 0.180 m.; total length of body, 0.045; length of tail, 0.029; length of head, 0.016; length of ear, 0.012; length of forearm, 0.030; length of thumb, 0.005½; length of second or index finger, 0.029½; length of third finger, 0.055; of fourth finger, 0.046; of fifth finger, 0.040; length of tibia, 0.011; length of foot to the end of nails, 0.006¾; length of calcar, 0.013.

"This is a rare species. I have only observed it at Habana (Cerro) in a house where it lived in a crack above the window, and in the field near Cárdenas, where I killed it while flying about at dusk. A female contained two embryos in May."[1]

---

[1] Pelaje, por encima pálido-pardo (los pelos con la base negruzca), por debajo pálido bermejízo-pardo (la base de los pelos también negruzca). Cara y membranas voladoras, morenas. La nariz aparece algo dividida por las ventanas saltonas; entre la nariz y los ojos hay en cada lado un rollo con pelos tiesos. Orejas ovales, alargadas (por delante con 8 mil. de alto). La base anterior, redonda y extendida hácia fuera; la posterior, pelada en el ángulo de la boca y extendida en un semicírculo, que inclinado hácia dentro hasta la orejuela, forma una segunda ampliación redonda. Orejuela oblonga, adelgazándose apénas, algo encorvada en forma de hoz hácia delante, y provista en la base del borde exterior con un lóbulo dentiforme. Uñas pardas.

Las medidas, tomadas de un ejemplar disecado, son:

Anchura entre las puntas del ala, 0.180 mil.; longitud hasta el fin del cuerpo, 0.045; longitud del rabo, 0.029; longitud de la cabeza, 0.016; longitud de la oreja, 0.012; longitud del antebrazo, 0.030; longitud del pulgar, 0.005½; longitud del segundo dedo ó índice, 0.029½; longitud del tercero dedo, 0.055; longitud del quarto dedo, 0.046; longitud del quinto dedo, 0.040; longitud de la tibia, 0.011; longitud del pié hasta el fin de les uñas, 0.006¾; longitud del espolón, 0.013.

Es especie rara. La he observado solamente en la Habana (Cerro) en una casa donde vivia, en las rendijas sobre una ventana, y en el campo cerca de Cárdenas, donde la maté al oscurecer volando. Una ♀ tenia en mayo dos embriones.

Genus RHOGEËSSA H. Allen.

1866. *Rhogeëssa* H. Allen, Proc. Acad. Nat. Sci., Phila., p. 285 (genus).
1873. *Rhogöessa* Marschall, Nomenclator Zoologicus, Mamm., p. 11.
1878. *Rhogeëssa* Dobson, Catal. Chiroptera Brit. Mus., p. 245 (subgenus of '*Vesperugo*').
1893. *Rhogeëssa* H. Allen, Monogr. Bats N. Am., p. 132 (genus).

Type species.—Rhogeëssa tumida H. Allen.

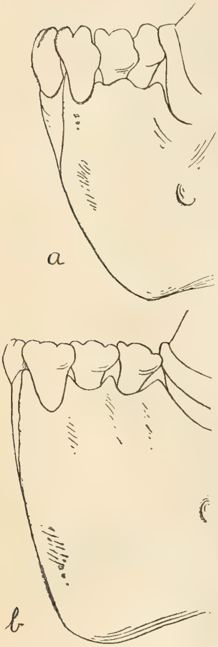


FIG. 37.—Left mandibular incisors of (*a*) *Rhogeëssa* and (*b*) *Nycticeius* (×20).

Geographic distribution.—Tropical Mexico, Central America, and probably northern South America (known from Margarita Island, Venezuela).

Generic characters.—Dental formula:

$$i, \frac{1-1}{3-3};\ c, \frac{1-1}{1-1};\ pm, \frac{1-1}{2-2};\ m, \frac{3-3}{3-3} = 30;$$

lower incisors crowded, the outer cusp of first and second obsolete; third lower incisor greatly reduced in size, unicuspidate (figs. 37 *a* and 38 *a*); upper incisor very close to canine or in contact with it; skull small, light, and papery, narrow and deep; external form variable, but tragus always straight or bent backward, and tail included to tip in interfemoral membrane.

Remarks.—The genus *Rhogeëssa* has received varying treatment. It was originally described as a full genus whose relationships were supposed to be with *Nycticeius* and *Nyctinomus*. In 1878 Dobson referred it to '*Vesperugo*' as a subgenus. This view has been adopted by most subsequent writers except Mr. Oldfield Thomas and Dr. Harrison Allen, both of whom have recognized *Rhogeëssa* as a full genus related more closely to *Nycticeius* than to any of the genera usually included under the name '*Vesperugo*.' Mr. Thomas has pointed out characters in which *Rhogeëssa* resembles *Antrozous*. These characters, the reduced size of the outer lower incisor and slightly crenulate posterior border of tragus, seem to be instances of parallel development rather than indications of genetic relationship. The genus *Rhogeëssa* is closely related to *Nycticeius*, but the peculiarities of the lower incisors and the general form of the skull are enough to warrant its recognition.

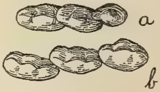


FIG. 38.—Crowns of incisors of right mandible of (*a*) *Rhogeëssa* and (*b*) *Nycticeius* (×20).

KEY TO SPECIES OF RHOGEËSSA.

Lateral mandibular incisor scarcely one-twentieth as large as central incisors .... *alleni* (p. 128)
Lateral mandibular incisor one-half to two-thirds as large as central incisors.
  Ear laid forward, reaching about 6 mm. beyond tip of nose ..... *gracilis* (p. 126)
  Ear laid forward, reaching about to tip of nose.
    Fur grayish brown at base .... *parvula* (p. 125)
    Fur yellowish throughout.
      Forearm about 30 mm .... *tumida* (p. 123)
      Forearm about 25 mm .... *minutilla* (p. 125)

RHOGEËSSA TUMIDA H. Allen.

1866. *Rhogeëssa tumida* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 286.
1877. *Vesperugo parvulus* Dobson, Catal. Chiroptera Brit. Mus., p. 245.

Type locality.—Mirador, Vera Cruz, Mexico.

Geographic distribution.—Central America and southern Mexico.

General characters.—Size small; length, 70 to 75; tail, 30 to 33; forearm, 27.4 to 30. Calcar strong, distinct, slightly longer than free border of uropatagium, terminating in a small but evident lobule conspicuously keeled on the posterior border. Free border of uropatagium naked. Ears moderate, laid forward they reach about to tip of nose. Wings from base of toes. Legs and feet short and strong, the feet when outstretched reaching to within 5 mm. of tip of tail. Fur yellowish, the hairs on the back with dusky tips.

Ears.—The ears (Pl. I, fig. 8) are moderately long, reaching, when laid forward, about to tip of nose; the substance of the conch thick and leathery. Anterior border strongly concave from base to a little past middle, then straight to narrowly rounded-off tip. Posterior border concave just below tip, then gently and evenly convex to base. No indication of basal notch.

Tragus directed slightly forward; the anterior edge nearly straight, but slightly concave at base, and curved a little backward at tip. Posterior edge faintly crenulate, concave below tip, then concave to slightly developed basal lobe. Greatest width of tragus at about middle of posterior border.

Membranes.—The membranes, especially the uropatagium, are remarkably thick and leathery for so small a bat. Throughout they are wholly naked except close to the body and along the veins on the interfemoral membrane. Wings from base of toes. Uropatagium (Pl. I, fig. 13) attached at tip of terminal caudal vertebra.

Feet.—The feet and legs (Pl. I, fig. 13) are short and strongly built, in this respect resembling *N. humeralis*. The foot is scarcely one-half as long as the tibia, and the toes are slightly longer than the sole. The toes are not united by membrane at base. Calcar distinct and strong, slightly longer than free border of uropatagium. Lobule at tip of calcar small but distinct. Keel well developed and supported by one or two cartilaginous outgrowths.

Fur and color.—There is nothing peculiar in the distribution of the fur. It extends in a very narrow line on the wings along the side of the body both dorsally and ventrally, and on the uropatagium covers the basal fourth dorsally but scarcely reaches the membrane on the ventral side.

In color the fur is dull yellowish brown throughout, scarcely paler ventrally, the hairs dusky at tip. Ears and membranes dark brown.

Skull.—In general appearance the skull of *Rhogeëssa tumida* (fig. 39) stands between that of *Nycticeius humeralis* and *Pipistrellus subflavus.* The skull of an adult female from Santo Domingo, Oaxaca (No. 73267, United States National Museum, Biological Survey collection), measures: Greatest length, 13; zygomatic breadth, 8.4; breadth of rostrum at anterior edge of first molar, 5; mandible, 9;[1] upper tooth row, 5.6; lower tooth row, 6. That of an adult female from Patuca, Honduras (No. 21017, United States National Museum), measures: Greatest length, 12.4; zygomatic breadth, 8; breadth of rostrum at anterior edge of first molar, 4; mandible, 9.4; upper tooth row, 5; lower tooth row, 6. The rostrum is relatively narrower than in *Nycticeius* and the occiput is more elevated. The muzzle is distinctly concave in front of orbits instead of flat or almost convex as in *Nycticeius.*

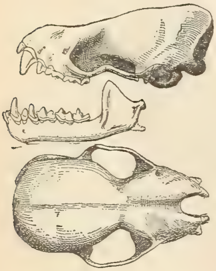


FIG. 39.—Skull of *Rhogeëssa tumida* (×2).

Teeth.—Upper incisor usually in contact with canine, though occasionally separated by a narrow space (fig. 40 *a*). Maxillary teeth essentially as in *Nycticeius*, but premolar relatively larger and posterior molar narrower in proportion to its length.

Lower incisors greatly crowded, the outer cusp of $\overline{i}$ 1 and $\overline{i}$ 2 much smaller than middle and inner cusp. Outer lower incisor unicuspidate, about one-half the size of $\overline{i}$ 1 or $\overline{i}$ 2. Other mandibular teeth essentially as in *Nycticeius*, but premolars more crowded.

Measurements.—See table, page 129.

Specimens examined.—Total number, 10, from the following localities:

Colima: Colima, 3.
Costa Rica: ———, 1.
Guatemala: Huehuetan, 1.
Guerrero: Amula, 1 (Merriam coll.).
Honduras: Patuca, 2.
Oaxaca: Santo Domingo, 1.
Vera Cruz: Mirador, 1.

General remarks.—*Rhogeëssa tumida* needs comparison with *R. parvula* and *R. minutilla* only. From the former it is distinguished by its clear yellowish fur without darker base, and from the latter by its considerably larger size.

---

[1] As the mandible is imperfect, this measurement is only approximately correct.

Dobson and most subsequent authors have wrongly applied the specific name *parvula* to this species. So far as known *R. parvula* is restricted to the Tres Marias Islands.

[The following species is not North American, but is introduced here to complete the account of the genus *Rhogeëssa.*]

RHOGEËSSA MINUTILLA Miller.

1896. *Vesperugo parvulus* Robinson, Proc. U. S. National Museum, XVIII, p. 651 (not *Rhogeëssa parvula* H. Allen).

1897. *Rhogeëssa minutilla* Miller, Proc. Biol. Soc. Washington, XI, p. 139, May 13, 1897.

Type locality.—Margarita Island, Venezuela. (Type in U. S. National Museum, No. 63216.)

Geographic distribution.—This species is probably confined to Margarita Island.

General characters.—Similar to *Rhogeëssa tumida*, but considerably smaller (forearm, only 25 mm.).

Ears.—The ears of the type (when relaxed by soaking in water) appear to be smaller and narrower than in *R. tumida*, but otherwise not peculiar.

Membranes, feet, and distribution of fur.—As in *R. tumida.*

Color.—Fur everywhere light yellowish brown to base, the hairs on the back tipped with chestnut. The color appears to differ slightly from that of *R. tumida*, but I have too few skins to make an adequate comparison.

Skull.—The skull of the type and only known specimen is so much injured that its characters can not be determined with certainty, but it appears to be smaller and relatively narrower than that of *R. tumida.* Greatest length, 11.8; length of mandible, 9; upper tooth row, 5; lower tooth row, 5.6.

Teeth.—The teeth are essentially as in *R. tumida.*

Measurements.—The measurements of the type specimen are given in the table on page 129.

Specimens examined.—One, the type.

General remarks.—*Rhogeëssa minutilla* is a small insular form most closely related to *R. tumida*, but apparently perfectly distinct. So far as I know the genus *Rhogeëssa* has not yet been recorded from the mainland of South America, where, however, it doubtless occurs.

RHOGEËSSA PARVULA H. Allen.

1866. *Rhogeëssa parvula* H. Allen, Proc. Acad. Nat. Sci. Phila., p. 285

Tpye locality.—Tres Marias Islands, Mexico.

Geographic distribution.—Tres Marias Islands.

Characters.—As I have seen no specimens of this species, I quote the original description entire. It is as follows:

"Ear sub-acute at tip; lips whiskered; eyes very small, each furnished with a wart above; similar growth seen beneath chin. Fur above silky, not thick, of a light greyish-brown at basal third, fawn-chestnut-brown at apical two-thirds; that of head same color, running on to the ears one-half their height. Beneath, basal third inclined to greyish; apical two-thirds grayish fawn. Membranes almost black, naked, excepting basal fourth of interfemoral membrane behind, which is furnished with a small, short patch of glistening fur.

"*Measurements*—7841. [Type]

"Height of auricle 6″ [12.7 mm.]; height of tragus 3″ [6.4]; length of head 7″ [14.8]; length of body 10″ [21.1]; length of tail 1′ 2″ [30.5]; length of forearm 1′ 1″ [27.4]; length of longest finger 1′ 11″ [48.5]; length of thumb 2″ [4.2]; length of tibia 5″ [10.6]; length of foot 2½″ [5.3]; expanse 6′ 7″ [16.7]. [Type]

"Two individuals, ♂ and ♀; Nos. 7841, 7842, Museum of Smithsonian Institution. Alcohol.

"Tres Marias, Mexico, Col. Grayson."

RHOGEËSSA GRACILIS sp. nov.

Type from Piaxtla, Puebla. Adult ♂ (in alcohol). No. 70694, U. S. Nat. Museum, Biological Survey collection. Collected Nov. 24, 1894, by E. W. Nelson and E. A. Goldman. Collector's number, 7099.

Geographic distribution.—Southern Mexico (Puebla and 'Isthmus of Tehuantepec').

General characters.—Size, medium; length, 79 to 82; tail, 38.6 to 41; forearm, 32 to 33. Calcar slender but distinct, a little shorter than free border of uropatagium, terminating in a small lobule, distinctly keeled on the posterior border. Free border of uropatagium naked. Ears long; when laid forward extending about 6 mm. beyond tip of nose. Wings from base of toes. Feet and legs long and slender, the outstretched feet reaching to within about 10 mm. of tip of tail.

Ears.—The ears (Pl. I, fig. 7) are long, and at the same time broad; laid forward they reach about 6 mm. beyond tip of nose; the substance of the conch thin and translucent. Anterior border strongly convex from base to a little below middle, then straight or very slightly convex to the rather broadly rounded off tip. Posterior border concave below tip to about middle, where it bends abruptly outward, then gradually convex to base. A very faintly indicated basal notch and basal lobe. About 5 mm. above the crown and an equal distance from the tip of the ear conch in the male is developed a conspicuous, flattened-pyriform, glandular thickening with the large end toward the anterior margin of the ear and the main axis nearly perpendicular to that of the auricle. The thickened mass is 5 mm. in length, 4 mm. wide at the broad end, 2 mm. at the narrow end, and 1 mm. thick. It is most conspicuous on the dorsal side of the ear, where, although not different in color from the rest of the ear, it is noticeably raised above the surface, and the boundaries are sharply marked. On the inner side of the ears the thickenings are less definite in outline, but are noticeably paler than the surrounding integument. When these structures are examined with a lens it is seen that they are thickly covered on the outer side with pores lying mostly at the bases of the fine hairs with which the surface is beset. The thickened masses are of exactly the same size and shape in the two ears and are placed symmetrically with respect to the outlines of the conchs.

Tragus slender and taper pointed, slightly bent backward at the tip, and broadest opposite anterior base. The anterior border is slightly concave at base, then evenly convex to tip. The posterior border is strongly concave from tip to a point slightly above the middle, where the tragus attains a width nearly equal to that at level of anterior base. From this point to the basal lobe the posterior border is nearly straight and about parallel with the lower part of the anterior border. Basal lobe small but prominent. Posterior border of tragus crenulate, especially near the middle, where there are five or six minute sharply projecting points, from the bases of which thickened processes may be traced a short distance into the substance of the tragus when the latter is held to the light.

Membranes.—The membranes are thin and semitransparent, the uropatagium not different in texture from the wings. Throughout they are entirely naked, except for a narrow line of hair on the wings extending along sides of body about to a line drawn halfway between knee and elbow. On the uropatagium there is also a narrow hairy area close to body and a sprinkling of fine hairs along the veins. Wings from base of toes. Uropatagium (Pl. I, fig. 12) attached at tip of terminal caudal vertebra.

Feet.—The feet are small and weak, distinctly less than half as long as the slender tibiæ (Pl. I, fig. 12). Toes longer than sole, cleft to base. Calcar slender but very distinct, about as long as free border of uropatagium and terminating in a small and ill-defined lobule. Keel remarkably well developed, extending from near tip of calcar almost to base and supported by four cartilaginous processes.

Fur and color.—The fur is long, that on middle of back averaging about 9 mm. It extends farther on the membranes than in *R. parvula*, but otherwise shows no peculiarities. In color it is everywhere light sepia at base, then dull yellowish brown, that on the back tipped with chestnut. As this description is from a specimen that has been immersed in alcohol for nearly two years and a half, it can not be more than approximately accurate.

Skull.—The skull of *Rhogeëssa gracilis* is longer and more slender than that of *R. tumida*, and the forehead appears to be more abruptly raised above the face line. The zygomata are less widely flaring in front. Apparently the occiput is considerably narrower than in *R. tumida.* From the material at hand it is, however, impossible to determine the cranial characters with accuracy, since of the skull of the female topotype there remains only the mandible and rostral portion, while the skull of the type is so much injured that it would not hold together if removed from the skin and cleaned.

Teeth.—The teeth of *Rhogeëssa gracilis* (fig. 40) differ from those of *R. tumida* in numerous details. The crowns of the upper molars are much narrower on the lingual side and the posterior upper molar is considerably broader. The front lower premolar is slightly larger than in *R. tumida*, but otherwise the mandibular teeth show no distinct differences.

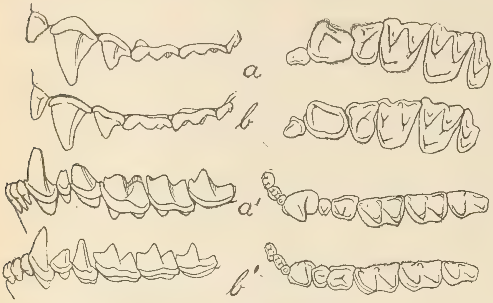


FIG. 40.—Teeth of (*a*) *Rhogeëssa tumida* and (*b*) *R. gracilis* (×5).

Measurements.—See table, page 129.

Specimens examined.—Total number, 3, from the following localities:

Isthmus of Tehuantepec, 1.
Puebla: Piaxtla, 2.

General remarks.—*Rhogeëssa gracilis* is so readily distinguished from the other species of the genus by its slender form and very large ears that no detailed comparisons are necessary.

This is the only species of North American *Vespertilionidæ* in which I have found any sexual differences in cutaneous structures.

RHOGEËSSA ALLENI Thomas.

1892. *Rhogeëssa alleni* Thomas, Ann. & Mag. Nat. Hist., 6th ser., X, p. 477, December, 1892.

Type locality.—Santa Rosalia, near Autlan, Jalisco, Mexico. Type in British Museum.

Geographic distribution.—*Rhogeëssa alleni* is known from the type locality only.

Characters.—As I have not seen the type and only known specimen of this bat, I copy Mr. Thomas's original description:

"Decidedly larger than *Rh. parvula;* muzzle obliquely truncate as in that species. Ears large, laid forward they reach about 1 or 2 millim. beyond the nostrils; their inner margin very convex forwards below, straight or even slightly concave above; tip narrowly rounded off; outer margin concave below the tip, then straight, becoming slightly convex below, outer basal lobe but little marked. Tragus long, its broadest point opposite to base of its inner edge; inner edge straight or slightly concave, tip rounded, outer margin slightly convex, the edge indistinctly crenulate, somewhat as in *Antrozous pallidus;* a marked lobule at the base of the outer margin, above and below which there is a concavity. Thumb very short and thick, no longer than in *Rh. parvula.* Posterior edges of wing-membrane bordered with white, bifid tip to fourth finger unusually distinct; wings from the base of the fifth toe; post-calcareal lobe small and narrow; tip of calcar projecting slightly from the back of the membrane; tail included in membrane to the extreme tip."

"*Teeth.*—Upper incisors one on each side, long, slender, unicuspid; upper premolars large, quite close to the canines; no trace of a minute anterior premolar. Lower incisors six, the four median ones broad, tricuspid; the outer ones unicuspid, exceedingly minute, practically invisible from in front, and scarcely one-twentieth of the size in cross section of the median incisors; far smaller therefore both absolutely and relatively than in *Rh. parvula*.

"Dimensions of the type (an adult female in spirit):—

"Head and body 47 millim; tail 41; ear above head 12.2, from notch 16; tragus, inner margin 7; forearm 35; thumb 5; metacarpal of third finger 33.5; lower leg 15.5; hind foot 7.1; calcar 15.

"Skull of a second specimen: Occiput to gnathion 14.7; greatest breadth 9.5; distance from front of canine to back of $\underline{\text{m. 3}}$ 5.4."

Measurements of specimens of Rhogeëssa.

Name.	Locality.	Number.	Sex and age.	Total length.	Tail vertebræ.	Tibia.	Foot.	Forearm.	Thumb.	Longest finger.	Ear from meatus.	Width of ear.	Tragus.
tumida	Vera Cruz: Mirador	8195	♂ ad.	65.5	25.4	10.4	5.1	29.5	4.8	57.2	....	....	7.3
	Colima: Colima	52102	♀ ad.	75	34	12	5	29.8	4	52	12.8	9.6	7
	Colima	52065	♂ ad.	70	33	11.4	5.4	30	4	52	12.4	9.4	7.4
	Colima	52066	♂ ad.	70	30	11	5.4	28	4	51	12.6	9	7
	Oaxaca: Santo Domingo.	73269	♀ ad.	....	....	12	7	33	4.4	63	13.6	9.6	7.2
	Guatemala: Huehuetan.	78600	♂ ad.	75	33	11.4	6	30	4.6	56	14	9	7
	Honduras: Patuca	21016	♀ ad.	73	30	12	6	30	4	55	12.6	9	7
	Patuca	21017	♀ ad.	75	31	12.4	5.6	30	4	57	13	9	7
parvula	Tres Marias Islands.....	7841	[1]♂ ad.	65.5	29.5	10.4	5.3	27.4	4.1	48.5	....	....	6.4
minutilla	Venezuela: Margarita Island.	63216	[2]♂ ad.	....	25	11	5	25	3.6	51	11.8	8	6.4
gracilis	Puebla: Piaxtla..........	70691	♀ ad.	79	38.6	14	6	32	4	60	17	11	10
	Piaxtla.........	70694	[2]♂ ad.	82	41	14.6	5	33	4.4	61	16.6	11.8	10
	Isthmus of Tehuantepec.	11240	♀ ad.	77	37	13	5	30	4	58	16	11	9
alleni	Jalisco: Autlan..........	....	[3]♀ ad.	....	41	....	7.1	35	5	....	....	....	7

[1] Type, measurements from H. Allen.

[2] Type.

[3] Type, measurements from Thomas.

INDEX TO GENERIC AND SPECIFIC NAMES.

[Names in italics are here recognized as valid.]

abramus (*Pipistrellus*), 10.
Adelonycteris, 12, 95.
  fuscus, 39, 96.
Aeorestes, 12, 55.
affinis (Vespertilio), 20, 38.
agilis (Vespertilio), 73.
alascensis (*Myotis*), 39, 40, 56, 63–64.
albescens (*Myotis*), 12, 59, 84.
albescens (Vespertilio), 20, 39, 64, 66.
albigularis (*Vespertilio*), 20, 39, 41, 104.
albigularis (Vesperugo), 39, 104.
albigularis (Vesperus), 15, 20, 104.
albolimbatus (Vesperugo), 20.
alcythoe (Vespertilio), 15, 95.
alleni (*Rhogeëssa*), 20, 40, 41, 123, 128–129.
americana (Atalapha), 13, 20, 106.
Antrozoinæ, 41.
Antrozous, 12, 42.
  pacificus, 38, 40, 45–46.
  pallidus, 38, 40, 43–45.
aristippe (Vesperugo), 20.
aristippe (Vesperus), 15.
arquatus (Vespertilio), 20, 96.
Artibeus, 18.
Atalapha, 13, 105, 115.
  americana, 13, 20, 106.
  borealis, 106.
  caudata, 13.
  cinerea, 40, 112.
  ega, 13.
  egregia, 13.
  frantzii, 25, 40, 111.
  fuscata, 26.
  intermedia, 13, 40, 116.
  mexicana, 31, 111.
  noveboracensis, 39, 106.
  pfeifferi, 33, 39, 110.
  seminola, 35, 109.
  sicula, 13.
  teliotis, 36, 39, 110.
auduboni (Vespertilio), 20, 86.
auritus (*Plecotus*), 140.
auritus, (Vespertilio), 18.
australis (*Pipistrellus*), 39, 40, 90.
austroriparius (Vespertilio), 20, 60.
bahamensis (*Vespertilio*), 39, 41, 101–102.
Barbastella, 17.
barbastellus (Vespertilio), 17.
bechsteinii (Vespertilio), 16.
belli (Scotophilus), 21.
blossevillei (Scotophilus), 15.
borealis (Atalapha), 106.
borealis (*Lasiurus*), 39, 41, 105–108.
borealis (Vespertilio), 21, 105.
brachmanus (Taphozous), 18.
Brachyotus, 13, 55.
brevirostris (Vespertilio), 21.
calcaratus (Vespertilio), 21.
californicus (*Myotis*), 39, 40, 56, 69–72.
californicus (Vespertilio), 21, 69.
capaccinii (Comastes). 13.
carolii (Vespertilio), 22, 38, 60.
carolinensis (Vespertilio), 22, 96.
carolinensis (Vesperugo), 39, 91.
Cateorus, 13, 95.
caudata (Atalapha), 13.
caurinus (*Myotis*), 39, 40, 56, 72.
Chalinolobus, 104.
chrysonotus (Vespertilio), 23, 77.
ciliatus (Vespertilio). 14.
ciliolabrum (*Myotis*), 39, 40, 56, 72–73.
ciliolabrum (Vespertilio), 23, 39, 72.
cinerea (Atalapha), 40, 112.
cinereus (*Lasiurus*), 40, 41, 105, 112–114.
cinereus (Vespertilio), 23, 112.
Cnephæus, 13, 95.
Cnephaiophilus, 13, 85.
  ferrugineus, 13.
  macellus, 13.
  noctivagans, 13.
  pellucidus, 13.
Comastes, 13, 55.
  capaccinii, 13.
  dasycneme, 13.
  limnophilus, 13.
  megapodius, 13.
Corynorhinus, 13, 49–50.
  macrotis, 13, 38, 40, 51–52.
  pallescens, 38, 40, 52–53.
  townsendii, 38, 40, 52, 53–54.
crassus (Vespertilio), 23.
creeks (Vespertilio), 24.
crepuscularis (Nycticea), 24, 118.
crepuscularis (Nycticejus), 40, 119.
cubanus (*Nycticeius*), 40, 41, 120–121.
cubanus (Vesperus), 24, 120.
cubensis (Scotophilus), 24, 102.
cubensis (*Vespertilio*), 39, 41, 102, 103.
cubensis (Vesperugo), 102.
cyanopterus (Vespertilio), 24.
cynocephalus (Nycticea), 25.
dasycneme (Comastes), 13.

dasycneme (Vespertilio), 13.
Dasypterus, 13, 54, 115–116.
  intermedius, 40, 41, 116–118.
daubentonii (Vespertilio), 13.
discolor (Vespertilio), 19.
discolor (Vesperugo), 14, 19, 20.
discolor (Vesperus), 15.
domesticus (Vespertilio), 25.
dutertreus (Vespertilio), 25, 102.
ega (Atalapha), 13.
egregia (Atalapha), 13.
Eptesicus, 13, 18, 95.
  melanops, 14, 30, 96.
  melas, 30.
  mydas, 14, 32.
erythrodactylus (Vespertilio), 25, 90.
Euderma, 14, 46.
  maculatum, 14, 38, 40, 46–49.
evotis (Myotis), 23, 39, 40, 56, 77–80.
evotis (Vespertilio), 25, 39, 77, 80.
exilis (Vespertilio), 25, 69.
ferrugineus (Cnephaiophilus), 13.
frantzii (Atalapha), 25, 40, 111.
funebris (Lasiurus), 26, 106.
fuscata (Atalapha), 26.
fuscus (Adelonycteris), 39, 96.
fuscus (Scotophilus), 39, 96.
fuscus (Vespertilio), 26, 39, 40, 96–99.
fuscus (Vesperus), 39, 96.
georgianus (Scotophilus), 39, 90.
georgianus (Vespertilio), 26, 29, 90.
georgianus (Vesperugo), 39, 91.
gracilis (Rhogeëssa), 40, 41, 123, 126–128.
greenii (Scotophilus), 27, 96.
gryphus (Vespertilio), 27, 39, 60, 75.
henshawii (Vespertilio), 27, 39, 69.
hesperus (Pipistrellus), 39, 40, 88–90.
hesperus (Scotophilus), 27, 39, 88.
hesperus (Vesperugo), 39, 88.
Histiotus, 14, 46.
  maculatus, 14, 30, 46.
humeralis (Nycticeius), 16, 40, 41, 118–120.
humeralis (Vespertilio), 16, 27, 118.
Hypexodon, 14.
  mystax, 14.
Hypsugo, 14, 87.
incautus (Vespertilio), 28, 56, 59.
intermedia (Atalapha), 13, 40, 116.
intermedius (Dasypterus), 40, 41, 116–118.
intermedius (Lasiurus), 28, 40, 116.
Isotus, 14, 55.
keenii (Myotis), 39, 40, 56, 77.
keenii (Vespertilio), 28, 77.
krascheninikowii (Vesperugo), 14.
kuhlii (Scotophilus), 17.
kuhlii (Vesperugo), 15, 20.
lanceolatus (Vespertilio), 28.
Lasionycteris, 14, 54, 85.
  noctivagans, 39, 40, 86–87.
Lasiurus, 14, 54, 105, 115.
  borealis, 39, 41, 105–108.
  cinereus, 40, 41, 105, 112–114.
  funebris, 26, 106.
  intermedius, 28, 40, 116.
  mexicanus, 40, 41, 105, 111–112.
  noveboracensis, 39, 106.
Lasiurus, *pfeifferi*, 39, 41, 105, 110.
  seminolus, 39, 41, 105, 109.
  teliotis, 39, 41, 105, 110–111.
lasiurus (Vespertilio), 28, 105.
lasurus (Vespertilio), 29, 105.
lecontii (Plecotus), 29, 51.
leibii (Vespertilio), 29.
leisleri (Pterygistes), 87.
leisleri (Vesperugo), 20.
leporinus (Vespertilio), 18.
lepturus (Vespertilio), 17.
leucippo (Vesperugo), 20.
leucippe (Vesperus), 15.
limnophilus (Comastes), 13.
longicrus (Myotis), 39, 40, 56, 64–65.
longicrus (Vespertilio), 29, 39, 64.
lucifugus (Myotis), 38, 40, 56, 59–63.
lucifugus (Vespertilio), 29, 38, 59, 60.
macellus (Cnephaiophilus), 13.
macleayii (Scotophilus), 30.
macropus (Vespertilio), 30, 39, 66, 67.
macrotis (Corynorhinus), 13, 38, 40, 51–52.
macrotis (Plecotus), 13, 30, 38, 51.
macrotis (Synotus), 38, 51.
maculatum (Euderma), 14, 38, 40, 46–49.
maculatus (Histiotus), 14, 30, 46.
Marsipolæmus, 15, 20, 104.
maurus (Vesperugo), 14.
Megaderma, 18.
megalotis (Vespertilio), 30.
melanops (Eptesicus), 14, 30, 96.
megapodius (Comastes), 13.
melanorhinus (Vespertilio), 30, 39, 69. 20
melanotus (Vespertilio), 30.
melas (Eptesicus), 30.
merriami (Vesperugo), 31, 88.
Meteorus, 15, 95.
mexicana (Atalapha), 31, 111.
mexicanus (Lasiurus), 40, 41, 105, 111–112.
mexicanus (Myotis), 39, 40, 56, 73.
mexicanus (Vespertilio), 31, 73.
minutilla (Rhogeëssa), 123, 125.
miradorensis (Vespertilio), 39, 40, 99–100.
miradorensis (Scotophilus), 31, 99.
monachus (Vespertilio), 31, 106.
monticola (Vespertilio), 31.
murinus (Vespertilio), 14, 15, 18, 19.
mydas (Eptesicus), 14, 32.
mydas (Vespertilio), 32.
Myotis, 15, 54, 55–56.
  alascensis, 39, 40, 56, 63–64.
  albescens, 12, 59, 84.
  californicus, 39, 40, 56, 69–72.
  caurinus, 39, 40, 56, 72.
  ciliolabrum, 23, 39, 40, 56, 72–73.
  evotis, 23, 39, 40, 56, 77–80.
  keenii, 39, 40, 56, 77.
  longicrus, 39, 40, 56, 64–65.
  lucifugus, 38, 40, 56, 59–63.
  mexicanus, 39, 40, 56, 73.
  myotis, 13, 15.
  nigricans, 12, 39, 40, 56, 74–75.
  saturatus, 39, 40, 56, 68–69.
  subulatus, 36, 39, 40, 56, 75–76.
  thysanodes, 39, 40, 56, 80–85.
  velifer, 38, 40, 56–59.

Myotis, villosissimus, 12.
  yumanensis, 39, 40, 56, 66–68.
myotis (*Myotis*), 13, 15.
myotis (Vespertilio), 15.
mystacinus (Vespertilio), 13, 17.
mystax (Hypexodon), 14.
mystax (Noctilio), 32.
mystax (Vespertilio), 32.
Nannugo, 15, 87.
nathusii (Vesperugo), 20.
nattereri (Vespertilio), 14, 15.
nigricans (*Myotis*), 12, 39, 40, 56, 74–75.
nigricans (Vespertilio), 32, 69, 74.
nilssoni (Vesperugo), 20.
nilssoni (Vesperus), 15.
nitidus (Vespertilio), 32, 39, 66. 69.
Noctilio, 18.
  mystax, 32.
  noveboracensis. 26.
noctivagans (Cnephaiophilus), 13.
noctivagans (*Lasionycteris*), 39, 40, 86–87.
noctivagans (Scotophilus), 39, 86.
noctivagans (Vespertilio), 14, 32, 86.
noctivagans (Vesperugo), 30, 86.
Noctula, 15, 95.
noctula (*Pterygistes*), 87.
noctula (Vesperugo), 20, 104.
Noctulinia, 87.
noveboracensis (Atalapha), 39, 106.
noveboracensis (Lasiurus), 39, 106.
noveboracensis (Noctilio), 26.
noveboracensis (Vespertilio), 32, 105.
noveboracus (Vespertilio), 32, 105.
Nycticea, 16, 118.
  crepuscularis, 24, 118.
  cynocephalus, 25.
Nycticeius, 15, 54, 118.
  cubanus, 40, 41, 120–121.
  humeralis, 16, 40, 41, 118–120.
  tesselatus, 16.
Nycticejus, 16, 118.
  crepuscularis, 40, 119.
Nycticeus, 16, 118.
Nycticeyx, 16, 118.
Nyctilestes, 16.
  serotinus, 16, 35.
Nyctitherium, 16.
  priscus, 33.
  velox, 37.
Nyctophilus, 42.
Nystactes, 16, 55.
obscurus (*Pipistrellus*), 39, 40, 93.
obscurus (Vespertilio), 33, 69.
oregonensis (Vespertilio), 33, 69.
Pachyotus, 15, 16.
pacificus (*Antrozous*), 38, 40, 45, 46.
pallescens (*Corynorhinus*), 38, 40, 52, 53.
pallidus (*Antrozous*), 38, 40, 43–45.
pallidus (Vespertilio), 12, 33, 43.
parvula (*Rhogeëssa*), 17, 33, 40, 41, 123, 125–126.
parvulus (Vesperugo), 40, 123, 125.
pellucidus (Cnephaiophilus), 13.
perspicillatus (Vespertilio), 18.
pfeifferi (Atalapha), 33, 39, 110.
pfeifferi (*Lasiurus*), 39, 41, 105, 110.
phaiops (Vespertilio), 30, 33, 96.
Pipistrellus, 16, 54, 87–88.
  abramus, 10.
  australis, 39, 40, 90.
  hesperus, 39, 40, 88–90.
  obscurus, 39, 40, 93.
  pipistrellus, 88.
  subflavus, 35, 39, 40, 88, 90–92.
  veræcrucis, 39, 40, 88, 93–95.
pipistrellus (*Pipistrellus*), 88.
pipistrellus (Vespertilio), 16.
pipistrellus (Vesperugo), 15, 20.
Plecotinæ, 41, 46.
Plecotus, 17, 18, 49.
  auritus, 140.
  lecontii, 29, 51.
  macrotis, 13, 30, 38, 51.
  rafinesquii. 34.
  townsendii, 13, 37, 53.
  velatus, 14.
priscus (*Nyctitherium*), 33.
propinquus (*Vespertilio*), 39, 40, 100–101.
propinquus (Vesperugo), 39, 100–101.
propinquus (Vesperus), 33, 100.
proterus (Vespertilio), 87.
pruinosus (Scotophilus), 15.
pruinosus (Vespertilio), 34, 112.
Pteropus, 18.
Pterygistes, 20. 87.
  leisleri, 87.
  noctula, 87.
pulverulentus (Vespertilio), 34, 86.
rafinesquii (Plecotus), 34.
Rhogeëssa 17, 54, 122–123.
  alleni. 20. 40, 41, 123, 128–129.
  gracilis, 40, 41, 123. 126–128.
  minutilla, 123, 125.
  parvula, 17, 33, 40, 41, 123, 125–126.
  tumida, 17, 37, 40, 41, 123–125.
Rhogöessa, 17, 122.
rubellus (Vespertilio), 34, 105.
rubra (Vespertilio), 34, 106.
rufus (Taphozous), 17.
rufus (Vespertilio), 34, 106.
salarii (Vespertilio), 34.
saturatus (*Myotis*), 39, 40, 56, 68–69.
savii (Vesperugo), 20.
savii (Vesperus), 15.
Scotophilus, 17.
Scotophilus, 85, 87, 95.
  bellii, 21.
  blossevillei, 15.
  cubensis, 24, 102.
  fuscus, 39, 96.
  georgianus, 39, 90.
  greenii, 27, 96.
  hesperus, 27, 39, 88.
  kuhlii, 17.
  macleayii, 30.
  miradorensis, 31, 99.
  noctivagans, 39, 86.
  pruinosus, 15.
Selysius, 17, 55.
seminola (Atalapha), 35, 109.
seminolus (*Lasiurus*), 39, 41, 105. 109.
septentrionalis (Vespertilio), 35, 75.
serotinus (*Nyctilestes*), 16, 35.

- *serotinus* (*Vespertilio*), 99.
- serotinus (Vesperugo), 20, 39, 95, 96.
- serotinus (Vesperus), 13.
- sicula (Atalapha), 13.
- spasma (Vespertilio), 18.
- spectrum (Vespertilio), 18.
- *subflavus* (*Pipistrellus*), 35, 39, 40, 88, 90–92.
- subflavus (Vespertilio), 35, 90.
- *subulatus* (*Myotis*), 36, 39, 40, 56, 75–76.
- subulatus (Vespertilio), 29, 36, 39, 75.
- Synotus, 17, 49.
  - macrotis, 38, 51.
  - townsendii, 38, 52.
- *Taphozous*, 17.
  - brachmanus, 18.
  - rufus, 17.
- teliotis (Atalapha), 36, 39, 110.
- *teliotis* (*Lasiurus*), 39, 41, 105, 110–111.
- tenuidorsalis (Vespertilio), 36, 69.
- tesselatus (Nycticeius), 16.
- tesselatus (Vespertilio), 36, 106.
- *thysanodes* (*Myotis*), 39, 40, 56, 80–85.
- *townsendii* (*Corynorhinus*), 38, 40, 52, 53–54.
- townsendii (Plecotus), 13, 37, 53.
- townsendii (Synotus), 38, 52.
- *tumida* (*Rhogeëssa*), 17, 37, 40, 41, 123–125.
- ursinus (Vespertilio), 37, 96.
- *Vampyrus*, 18.
- vampyrus (Vespertilio), 18.
- velatus (Plecotus), 14.
- *velifer* (*Myotis*), 38, 40, 56–59.
- velifer (Vespertilio), 37, 38, 39, 56, 80.
- *velox* (*Nyctitherium*), 37.
- *veræcrucis* (*Pipistrellus*), 39, 40, 88, 93–95
- veræcrucis (Vesperugo), 37, 93.
- Vesperides, 18, 85.
- *Vespertilio*, 18, 54, 55, 95.
  - affinis, 20, 38.
  - agilis, 73.
  - albescens, 20, 39, 64, 66.
  - *albigularis*, 20, 39, 41, 104.
  - alcythoe, 15, 95.
  - arquatus, 20, 96.
  - auduboni, 20, 86.
  - auritus, 18.
  - austroriparius, 21, 60.
  - *bahamensis*, 39, 41, 101–102.
  - barbastellus, 17.
  - bechsteinii, 16.
  - borealis, 21, 105.
  - brevirostris, 21.
  - calcaratus, 21.
  - californicus, 21, 69.
  - carolii, 22, 38, 60.
  - carolinensis, 22, 96.
  - chrysonotus, 23, 77.
  - ciliatus, 14.
  - ciliolabrum, 23, 39, 72.
  - cinereus, 23, 112.
  - crassus, 23.
  - creeks, 24.
  - *cubensis*, 39, 41, 102–103.
  - cyanopterus, 24.
  - dasycneme, 13.
  - daubentonii, 13.
  - discolor, 19.
- *Vespertilio*, domesticus, 25.
  - dutertreus, 25, 102.
  - erythrodactylus, 25, 90.
  - evotis, 25, 39, 77, 80.
  - exilis, 25, 69.
  - *fuscus*, 26, 39, 40, 96–99.
  - georgianus, 26, 29, 90.
  - gryphus, 27, 39, 60, 75.
  - henshawii, 27, 39, 69.
  - humeralis, 16, 27, 118.
  - incautus, 28, 56, 59.
  - keenii, 28, 77.
  - lanceolatus, 28.
  - lasiurus, 28, 105.
  - lasurus, 29, 105.
  - leibii, 29.
  - leporinus, 18.
  - lepturus, 17.
  - longicrus, 29, 39, 64.
  - lucifugus, 29, 38, 59, 60.
  - macropus, 30, 39, 66, 67.
  - megalotis, 30.
  - melanorhinus, 30, 39, 69.
  - melanotus, 30.
  - mexicanus, 31, 73.
  - *miradorensis*, 39, 40, 99–100.
  - monachus, 31, 106.
  - monticola, 31.
  - *murinus*, 14, 15, 18, 19.
  - mydas, 32.
  - myotis, 15.
  - mystacinus, 13, 17.
  - mystax, 32.
  - nattereri, 14.
  - nigricans, 32, 69, 74.
  - nitidus, 32, 39, 66, 69.
  - noctivagans, 14, 32, 86.
  - noveboracensis, 32, 105.
  - noveboracus, 32, 105.
  - obscurus, 33, 69.
  - oregonensis, 33, 69.
  - pallidus, 12, 33, 43.
  - perspicillatus, 18.
  - phaiops, 30, 33, 96.
  - pipistrellus, 16.
  - *propinquus*, 39, 40, 100–101.
  - proterus, 87.
  - pruinosus, 34, 112.
  - pulverulentus, 34, 86.
  - rubellus, 34, 105.
  - rubra, 34, 106.
  - rufus, 34, 106.
  - salarii, 34.
  - septentrionalis, 35, 75.
  - serotinus, 99.
  - spasma, 18.
  - spectrum, 18.
  - subflavus, 35, 90.
  - subulatus, 29, 36, 39, 75.
  - tenuidorsalis, 36, 69.
  - tesselatus, 36, 106.
  - ursinus, 37, 96.
  - vampyrus, 18.
  - velifer, 37, 38, 39, 56, 80.
  - villosissimus, 16.
  - virginianus, 37.

Vespertilio, volans, 38, 69.
  yumanensis, 38, 39, 66, 69.
Vespertilionidæ, 41.
Vespertilioninæ, 41, 54.
Vesperugo, 19, 85, 87, 95.
  albigularis 39, 104.
  albolimbatus, 20.
  aristippe, 20.
  carolinensis, 39, 91.
  cubensis, 102.
  discolor, 14, 19, 20.
  georgianus, 39, 91.
  hesperus, 39, 88.
  krascheninikowii, 14.
  kuhlii, 15, 20.
  leisleri, 20.
  leucippe, 20.
  maurus, 14.
  merriami, 31, 88.
  nathusii, 20.
  nattereri, 14, 15.
  nilssoni, 20.
  noctivagans, 39, 86.
  noctula, 20, 104.
Vesperugo, parvulus, 40, 123, 125.
  pipistrellus, 15, 20.
  propinquus, 39, 100–101.
  savii, 20.
  serotinus, 20, 39, 95, 96.
  veræcrucis, 37, 93.
Vesperus, 20, 95.
  albigularis, 15, 20, 104.
  aristippe, 15.
  cubanus, 24, 120.
  discolor, 15.
  fuscus, 39, 96.
  leucippe, 15.
  nilssoni, 15.
  propinquus, 33, 100.
  savii, 15.
  serotinus, 13.
villosissimus (*Myotis*), 12.
villosissimus (Vespertilio), 16.
virginianus (Vespertilio), 37,
volans (Vespertilio) 38, 69.
yumanensis (*Myotis*), 39, 40, 56, 66–68.
yumanensis (Vespertilio), 38, 39, 66, 69.

PLATE I.

[One and one-half times natural size.]

FIG. 1. *Myotis velifer* (J. A. Allen). Patzcuaro, Michoacan, Mexico. (No. 52179, U. S. Nat. Mus.)

2. *Myotis californicus* (Audubon & Bachman). Nicasio, Cal. (No. 1512, Merriam collection.)

3. *Myotis yumanensis* (H. Allen). Tulare, Cal. (No. 30709, U. S. Nat. Mus.)

4. *Nycticeius humeralis* Rafinesque. Brownsville, Tex. (No. 52613, U. S. Nat. Mus.)

5. *Myotis thysanodes* Miller (topotype). Old Fort Tejon, Cal. (29824, U. S. Nat. Mus.)

6. *Myotis evotis* (H. Allen). Bull Lake, Wyoming. (No. 55846, U. S. Nat. Mus.)

7. *Rhogeëssa gracilis* Miller (type). Piaxtla, Puebla, Mexico. (No. 70694, U. S. Nat. Mus.)

8. *Rhogeëssa tumida* H. Allen. Colima, Mexico. (No. 52065, U. S. Nat. Mus.)

9. *Corynorhinus macrotis townsendii* (Cooper). Gold Beach, Oregon. (No. 88542, U. S. Nat. Mus.)

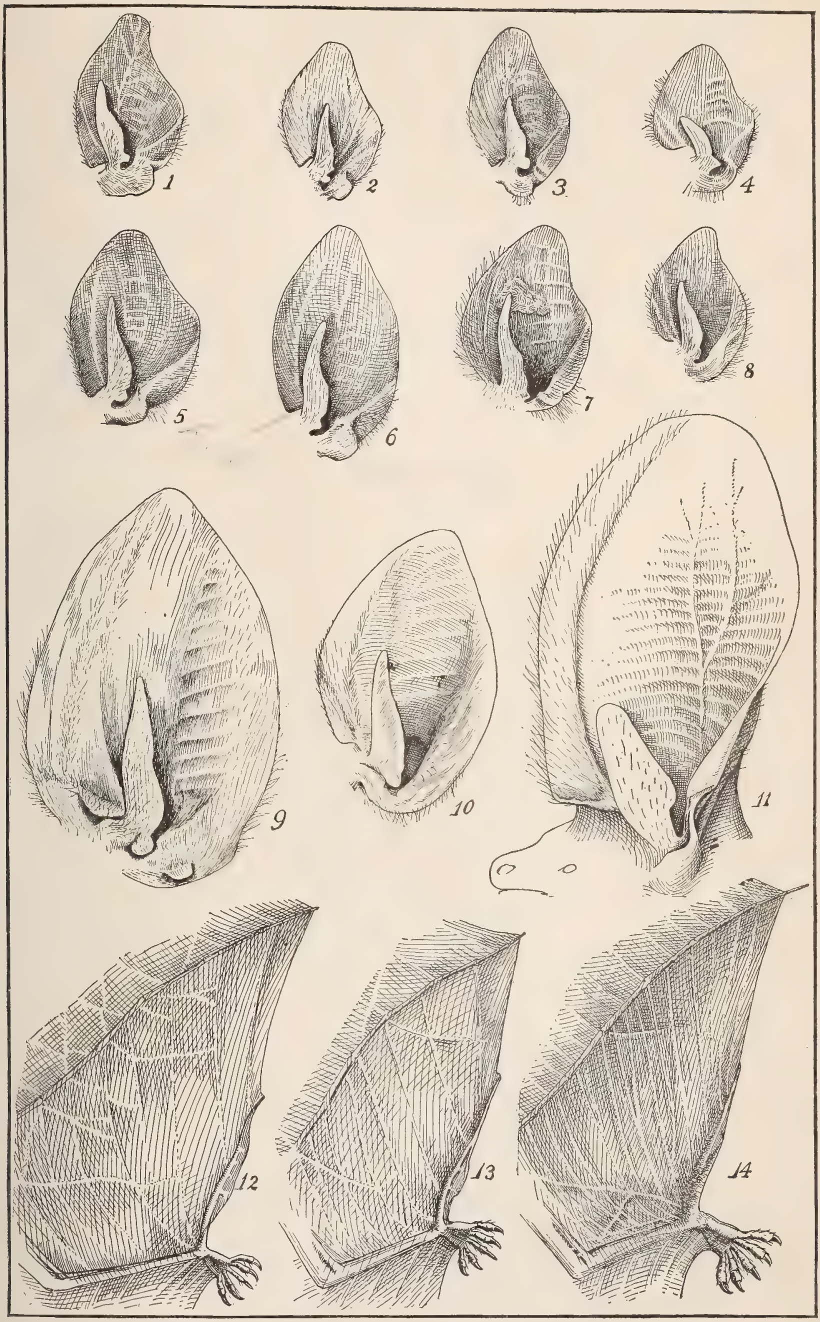
10. *Antrozous pallidus* (Le Conte). Sycamore Creek, Texas. (No. 24155, U. S. Nat. Mus.)

11. *Euderma maculatum* (J. A. Allen) (type). Ventura County, Cal. (No. $\frac{3920}{2991}$, Am. Mus. Nat. Hist., N. Y.)

12. *Rhogeëssa gracilis* Miller (type). Piaxtla, Puebla, Mexico. (No. 70694, U. S. Nat. Mus.)

13. *Rhogeëssa tumida* H. Allen. Colima, Mexico. (No. 52065, U. S. Nat. Mus.)

14. *Nycticeius humeralis* Rafinesque. Brownsville, Tex. (No. 52613, U. S. Nat. Mus.)

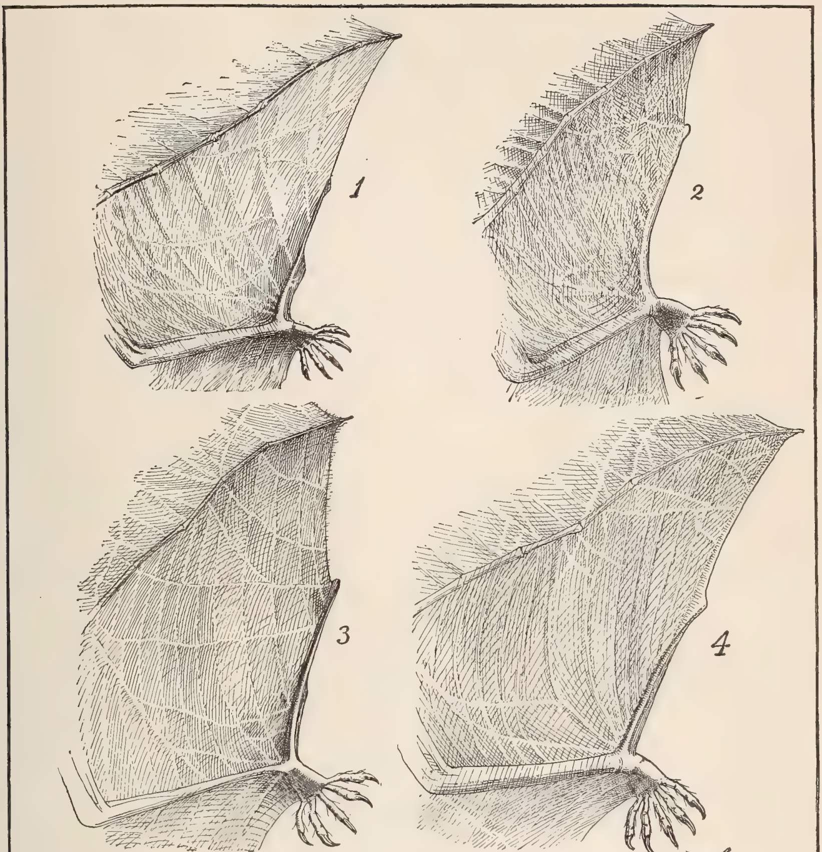


1. *Myotis velifer.*
2. *Myotis californicus.*
3. *Myotis yumanensis.*
4. *Nycticeius humeralis.*
5. *Myotis thysanodes.*
6. *Myotis evotis.*
7. *Rhogeëssa gracilis.*
8. *Rhogeëssa tumida*
9. *Corynorhinus macrotis townsendi.*
10. *Antrozous pallidus.*
11. *Euderma maculatum.*
12. *Rhogeëssa gracilis.*
13. *Rhogeëssa tumida.*
14. *Nycticeius humeralis.*

PLATE II.

[One and one-half times natural size.]

FIG. 1. *Myotis californicus* (Audubon & Bachman). Nicasio, Cal.
(No. 1512, Merriam collection.)
2. *Myotis yumanensis* (H. Allen). Tulare, Cal.
(U. S. Nat. Mus.)
3. *Myotis evotis* (H. Allen). Bull Lake, Wyoming.
(No. 55846, U. S. Nat. Mus.)
4. *Myotis evotis* (H. Allen). Perote, Vera Cruz, Mexico.
(No. 88541, U. S. Nat. Mus.)
5. *Myotis thysanodes* Miller (type). Old Fort Tejon, California.
(No. 29827, U. S. Nat. Mus.)
6. *Myotis velifer* (J. A. Allen). Patzcuaro, Michoacan, Mexico.
(No. 52282, U. S. Nat. Mus.)

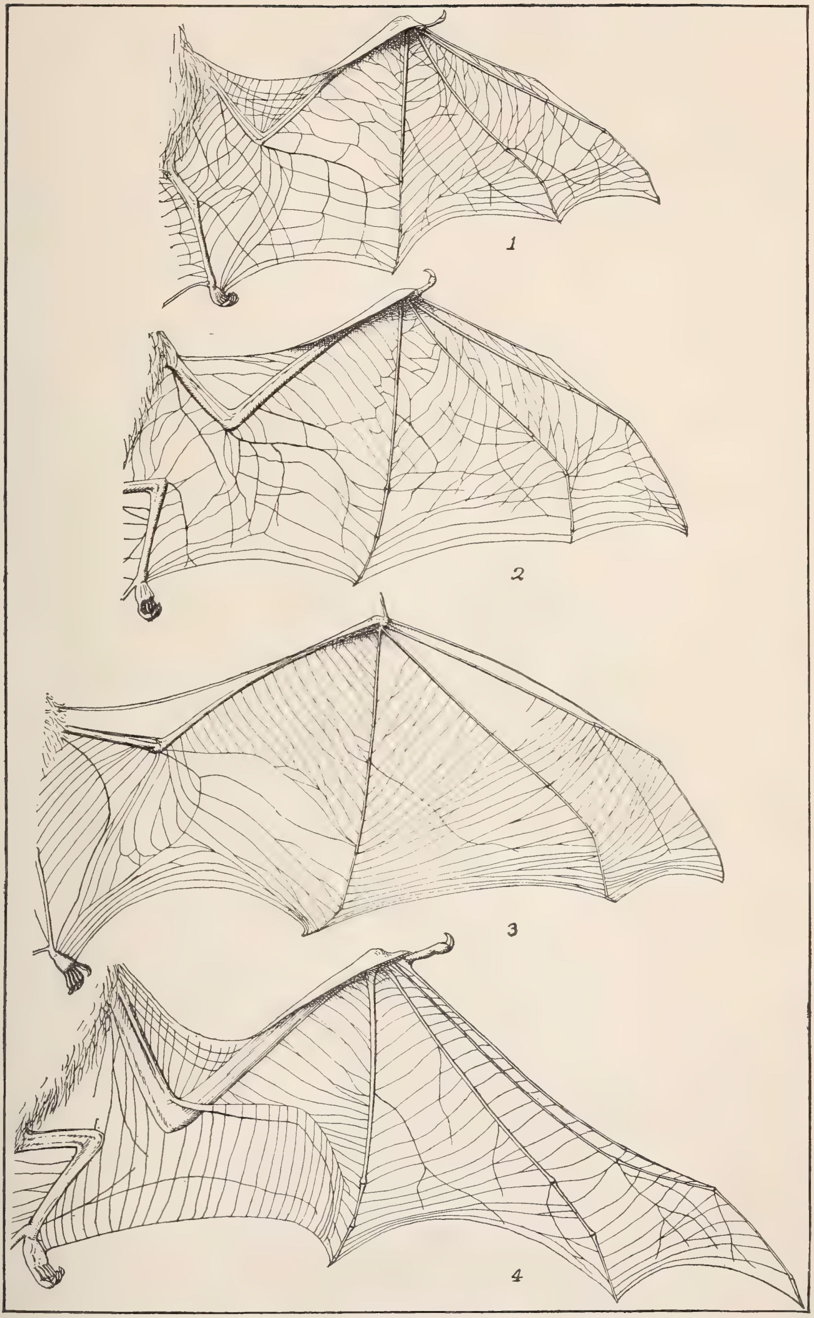


1. *Myotis californicus.*
2. *Myotis yumanensis.*
3. *Myotis evotis* (Bull Lake, Wyo.).
4. *Myotis evotis* (Perote, Mexico).
5. *Myotis thysanodes.*
6. *Myotis velifer.*

PLATE III.

[Two-thirds natural size.]

FIG. 1. *Plecotus auritus* (Linn.). Höllsteig, Baden, Germany.
(No. 4495, Miller collection.)
2. *Corynorhinus macrotis pallescens* Miller. Owens Lake, Cal.
(No. 28954, U. S. Nat. Mus.)
3. *Euderma maculatum* (J. A. Allen) (type). Ventura County, Cal.
(No. $\frac{3920}{2991}$, Am. Mus. Nat. Hist., N. Y.)
4. *Lasiurus cinereus* (Beauvois). Vegas Valley, Nevada.
(No. 27976, U. S. Nat. Mus.)



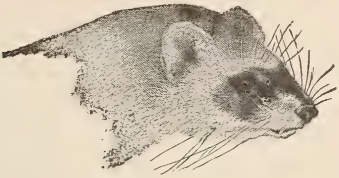
1. *Plecotus auritus.*
2. *Corynorhinus macrotis pallescens.*
3. *Euderma maculatum.*
4 *Lasiurus cinereus.*

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

NORTH AMERICAN FAUNA

No. 14

[Actual date of publication, April 29, 1899]



NATURAL HISTORY OF THE TRES MARIAS ISLANDS, MEXICO

General Account of the Islands, with Reports on Mammals and Birds. By E. W. Nelson
Reptiles of the Tres Marias. By Leonhard Stejneger
Notes on Crustacea of the Tres Marias. By Mary J. Rathbun
Plants of the Tres Marias. By J. N. Rose
Bibliography of the Tres Marias. By E. W. Nelson

Prepared under the direction of
Dr. C. HART MERRIAM
CHIEF OF DIVISION OF BIOLOGICAL SURVEY

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1899

LETTER OF TRANSMITTAL.

U. S. Department of Agriculture,
Division of Biological Survey,
Washington, D. C., January 25, 1899.

Sir: I have the honor to transmit herewith for publication as North American Fauna No. 14 a report by E. W. Nelson on the natural history of the Tres Marias Islands, Mexico. These islands are the largest off the west coast between Cape St. Lucas and the Isthmus of Panama, but have seldom been visited, and very little is known of their fauna or flora. For several years Mr. Nelson has had charge of the field work of the Biological Survey in Mexico, and in May, 1897, visited the Tres Marias. During the course of this visit he made a thorough collection of birds and mammals and also secured specimens of reptiles, fishes, mollusks, crustaceans, and plants, so that his report contains a fairly complete account of the natural history of the islands. In working up the material collected, Mr. Nelson has had the assistance of several well known naturalists in the United States National Museum and United States Fish Commission, who have prepared reports on special groups, as credited in detail on page 13.

Mention should be made also of the unfailing courtesy and interest of the Mexican Government in the investigations conducted by the Biological Survey in Mexico. Letters have been furnished by officials in the City of Mexico, and by the late Mexican minister in Washington, Señor Don Matias Romero, which greatly facilitated the work in various ways, and on the occasion of the visit to the Tres Marias enabled Mr. Nelson to borrow a large boat at San Blas and secure comfortable quarters on the islands.

Several attempts at agriculture have been made on the Tres Marias Islands, but the results have thus far been unsuccessful, owing to the dry climate and the scarcity of permanent water. Corn and beans have been grown on a small scale, but the crops suffer from the severe storms which occur at certain seasons. Experiments have been made with a view to utilizing the native species of agave for fiber and mescal, and the cultivation of cotton has also been tried without success. Recently it has been proposed to establish an American colony on one of the islands for the purpose of growing coffee, bananas, Australian chestnuts, and date palms, and to engage in the manufacture of banana and chestnut flour. Such a scheme, Mr. Nelson tells me, could only result in failure, as the islands are entirely unsuited to growing these products. It therefore seems desirable to publish at once all the information in the possession of the Department, for the purpose of making it available to those who may be interested in the islands or their products.

Respectfully,

C. HART MERRIAM,
Chief, Biological Survey.

HON. JAMES WILSON,
Secretary of Agriculture.

CONTENTS.

	Page.
General description of the Tres Marias Islands, Mexico. By E. W. Nelson	7
Mammals of the Tres Marias Islands. By E. W. Nelson	15
Birds of the Tres Marias Islands. By E. W. Nelson	21
Reptiles of the Tres Marias Islands. By Leonhard Stejneger	63
Notes on Crustacea of the Tres Marias Islands. By Mary J. Rathbun	73
Plants of the Tres Marias Islands. By J. N. Rose	77
Partial Bibliography of the Tres Marias Islands. By E. W. Nelson	93

ILLUSTRATIONS.

PLATE.

Map of the Tres Marias Islands .... Frontispiece.

FIGURES.

	Page.
1. *Erythrina lanata* Rose	81
2. *Euphorbia nelsoni* Millspaugh	89

No. 14. NORTH AMERICAN FAUNA. April 29, 1899.

GENERAL DESCRIPTION OF THE TRES MARIAS ISLANDS, MEXICO.

By E. W. Nelson.

INTRODUCTION.

The Tres Marias islands are situated off the west coast of Mexico, about 65 miles west from the port of San Blas. These islands have been known since early in the history of the New World, and in 1532 were named Las Islas de la Magdalena by Diego de Mendoza. Many of the early explorers sailed about them, and Dampier states that they were familiar to the buccaneers who visited these shores. They are mentioned by several of the later voyagers, especially the English exploring expeditions which visited the west coast of Mexico in the first half of the present century. During all this time, however, they remained uninhabited and nothing definite was known or published concerning their character or products. It is said at San Blas that the first men who lived upon the islands were bandits, who took refuge there, and had a secure retreat from which they harried the mainland settlements for several years. Finally, the abundance of Spanish cedar became known, a settlement of woodcutters was established on Marie Madre, and this island has since been continuously inhabited.

Col. A. J. Grayson, a naturalist who lived for many years on the west coast of Mexico, was the first to publish any detailed information about the islands.[1] Most of this information is contained in the various papers embodying the results of his three trips to the Tres Marias in 1865, '66, and '67, published by himself, George N. Lawrence, and W. E. Bryant. In 1881 Alphonse Forrer, a natural history collector, spent some time on Maria Madre collecting specimens for the British Museum, but no detailed account of his work has been published. No other naturalist is known to have visited the islands until the spring of 1897. In April of that year Mr. E. A. Goldman and I visited the port of San Blas for the purpose of outfitting an expedition to the Tres Marias. A letter to the collector of customs at San Blas, kindly furnished me by the Mexican Minister in Washington, the late Don Matias Romero, proved of the greatest service. The collector of customs rendered every assistance in his power, including the loan of a large open boat 25 feet long, and a letter to his deputy which secured us very pleasant quarters in the custom house on Maria Madre. While preparations for the trip were in progress a party from Socorro, N. Mex., consisting of Prof. C. L. Herrick, his son Harry, and Dr. T. S. Maltby arrived at San Blas, also bound for the Tres Marias, and we made the trip together. On the evening of April 28 the boat crept out of the lagoon, and by the aid of a faint land breeze edged slowly off shore. The islands came in sight the next morning, but it was impossible to reach them for several days, owing to calms, head winds, and the lack of a keel to the boat. The stock of water was on the point of exhaustion when Maria Madre was finally reached, three days later, on the afternoon of May 2.

---

[1] Mr. John Xantus, who spent several years subsequent to 1859 on the west coast of Mexico, was supposed to have visited the islands, on account of several specimens of birds which he sent to the Smithsonian Institution, labeled "Tres Marias Islands, 1861." But as no one else has collected any of these species, and as Xantus sent in no birds which have been taken by others on the islands, it is safe to conclude that he did not visit the Tres Marias.

The landing was made at the settlement at the head of a shallow bay on the east side of the island. Our letters secured a cordial welcome from the customs inspector and the agent of the owner of the islands. In a couple of hours the outfit was snugly installed on the broad upper verandas of the custom house, where our headquarters were located. Collections were made near this place, the island traversed both on foot and horseback, and on May 20 a boat trip was made to the north end of the island and across to San Juanito. On May 23 the party returned to the settlement, and two days later proceeded to Maria Magdalena, where camp was made near the beach for four days. On May 29 we crossed to Maria Cleofa, where we remained two days, and then started, May 31, on the return to the mainland. The wind was fair, and a quick trip was made, San Blas being reached on the evening of June 1.

When Colonel Grayson visited the islands, in 1865, he found a settlement on Maria Madre, but the other islands uninhabited. In the spring of 1897 there was a branch custom-house, with three inspectors, at the main settlement on Maria Madre, which had supervision of the shipment of salt and Spanish cedar. The settlement contained about twenty-five families, all of whom, except the customs inspectors, were in the service of the owner of the islands, Señora Gil de Azcona, who lived in the city of Tepic, on the mainland. In May and June the workmen are employed in salt-making at a lagoon near the south point of the island, where there is a small group of houses. The rest of the year they are occupied in cutting cedar and hauling it to the beach for shipment. The available supply of this valuable timber is now approaching exhaustion. Subsequent to Grayson's visit a settlement of woodcutters was made on the northeast side of Maria Magdalena, and a number of houses were built and a field cleared. We found the place deserted, the houses in ruins, and the field overgrown with thorny bushes.

The amount of land suitable for agriculture upon the islands is very limited and forms but a small percentage of the total area. A few cattle are raised on Maria Madre, but the scanty herbage and great scarcity of water during the long dry season limit this industry to the most insignificant proportions. There is a small field near the settlement, where coarse grass is grown for stock. Attempts have been made to grow corn and beans to supply the residents, but the fierce summer storms of wind and rain, called 'chubascos,' which beat the crops to the ground, have rendered these efforts futile. At present all food supplies are brought from the mainland. A number of years ago a house was built and a field cleared and fenced near the north end of the island for the purpose of growing cotton. A warehouse was also built at the main settlement, but after a trial the owner was forced to abandon the industry, the field and house were deserted, and the place is now overgrown with bushes. Subsequently it was proposed to utilize the agaves, which grow abundantly near the north end of the island, for fiber and for distilling from their fleshy bases the alcoholic product known as 'mescal.' Machinery was obtained, but the owner died before the industry was exploited.

In winter the weather is dry and pleasant, and small coasting steamers stop every now and then to take on wood for fuel, and sailing vessels call for Spanish cedar or, in spring, for salt. In May the inhabitants are obliged to lay in a stock of provisions sufficient for several months, as they are practically cut off from communication with the mainland during summer, when the islands are avoided on account of the storms that sweep over them. Many objects drift out from the Gulf of California after storms and are cast up on the shores. In September, 1896, a great tornado of wind and rain swept over northern Sinaloa and the Gulf of California; the coast lowlands were devastated by the flooded rivers, and crops and forests were alike overwhelmed and swept to sea. In May, 1897, the shore of Maria Madre was still strewn with cornstalks, driftwood, and other wreckage that had been stranded after this storm.

Our obligations to the collector of customs at San Blas and his agent on Maria Madre have already been mentioned, and acknowledgments are due also to the owner of the islands, Señora Gil de Azcona, whose letter procured us the use of horses and other courtesies.

PHYSIOGRAPHY.

The Tres Marias are situated between latitude 21° and 22° and longitude 106° and 107° (see frontispiece). Between the islands and the mainland, 20 miles offshore, lies Isabel Island, only about a mile long and 150 feet high. The soundings in the channel between the mainland and the islands gradually deepen to less than 300 fathoms, but just west of the group the sea bottom drops rapidly to more than 1,500 fathoms. The absence of a deep channel shows that they are continental islands, as distinguished from the oceanic Revillagigedo group, farther west.

The Tres Marias group comprises four islands, San Juanito, Maria Madre, Maria Magdalena, and Maria Cleofa, arranged in a northwest and southeast direction. Maria Madre, the largest, measures about 8 by 15 miles, and rises over 2,000 feet above the sea. North of this, and separated from it by a channel 4 miles wide and 5 or 6 fathoms deep, is San Juanito, an islet 3 or 4 miles in diameter and about 100 feet high. Next southeast of Maria Madre is Maria Magdalena, roughly triangular in outline and 7 or 8 miles across, with its central summit rising to an altitude of about 1,500 feet. A shallow channel 8 miles wide separates it from Maria Madre. Southeast of Maria Magdalena lies Maria Cleofa, the last of the group. It is irregularly rounded in outline, about 3 miles across, and its altitude is apparently much less than 1,320 feet, as given on the charts. The channel between the two last-named islands is about 12 miles wide and much deeper than the others.

With the exception of San Juanito, which is nearly flat with a narrow border of low bluffs along the north shore, the islands are mountainous and rise in successive slopes from the shore to the culminating point near the center. The interior of Maria Madre is occupied by a mountainous ridge extending almost the entire length of the island, but descending to a gently sloping area near each end. The eastern side of the island has the longer slope, while the westward or seaward face is much more abrupt, thus corresponding with the formation of the mountains parallel to the coast on the adjacent mainland. Both slopes of the island are scored at intervals with canyons which usually descend in a nearly direct line to the sea. Maria Magdalena and Maria Cleofa are occupied by a central mountainous elevation, from which canyons descend in all directions to the sea. The northeastern points of both these islands are low, flat, sandy areas of limited extent, and the western faces are rocky and precipitous. Permanent fresh water is very scarce on all the islands. There are three little streams on Maria Madre, which sink several miles from the sea during the dry season, and one each on Maria Magdalena and Maria Cleofa.

The relative situation of the islands, with the narrow, shallow channels between them, shows conclusively that at one time they formed a single island at least 45 or 50 miles long, and at a still earlier stage they must have been connected with the mainland. One of the strongest proofs of this former connection is shown by the correspondence between the fauna and flora. The breaking down of the original island into several smaller ones and the evident continuous encroachment of the sea appear to indicate that the subsidence is still in progress. The country back of the coast on the mainland was, within a comparatively recent period, the scene of great volcanic activity, and the Tres Marias bear evidence of having undergone various oscillations in level. On Maria Madre there are great beds of marine deposits, hundreds of feet above sea level, containing quantities of shells and corals of species now living along the shore. Isabel Island, near the mainland, is of volcanic origin and exhibits similar evidence of having once been a much larger island which is now sinking. Apparently it consists mainly of the remains of an old volcano, and a small crater still occupies the center of the island. Although no craters were seen on the Tres Marias, yet there are lavas and other volcanic rocks on all the islands, but a large part of the formation is made up of other rocks elevated by the volcanic uplift.

FAUNA.

The Tres Marias, like the adjacent coast, lie within the Arid Tropical life zone. The evidence furnished by the fauna of the former connection of the Tres Marias with the mainland is as follows: Six species of land shells were obtained, which, according to Dr. William H. Dall, are widely distributed on the mainland. These species are *Polygyra ventrosula* Pfr., *Orthalicus undatus* Brug., *Orthalicus undatus melanocheilus* Val., *Lamellaxis* ———?, *Opeas subula* Pfr., and *Glandina turris*, Pfr. A fresh-water fish taken on Maria Magdalena and Maria Cleofa has been identified by Prof. B. W. Evermann as *Agonostomus nasutus* Günther, a common species on the mainland. In fresh-water pools on Maria Magdalena two or three individuals of another small fish were seen, which were very similiar to common mainland species of *Awaous*, and undoubtedly belong to this or a closely allied genus. Six of the seven species of lizards inhabit the mainland, and only one is peculiar to the islands; the mud turtle and crocodile are also found on the mainland, as are the eight species of snakes. Concerning the reptilian fauna Dr. Stejneger remarks: "Thus most of the species are common on the opposite mainland and generally distributed over tropical Mexico and Central America. Then again it seems as if the species are practically identical on all the islands of the group. This would indicate a comparatively recent severance of these islands from each other, as well as from the opposite mainland of Mexico."

The birds and mammals seem to have been more susceptible to modifying influences than other forms of life. Thirty-six species of resident land birds were found on the group, of which twelve are identical with those on the mainland, and twenty-four can be distinguished specifically or subspecifically. We found ten species of indigenous mammals, seven of which, acccording to Dr. Merriam, are peculiar to the islands, but closely related to species living on the mainland.

ANIMALS PECULIAR TO THE TRES MARIAS.

So far as known, the following species and subspecies (with the exception of *Compsothlypis insularis*) are peculiar to the islands:

MAMMALS.

Marmosa insularis Merriam.
Oryzomys nelsoni Merriam.
Peromyscus madrensis Merriam.
Lepus graysoni Allen.
Procyon lotor insularis Merriam.
Rhogeëssa parvula H. Allen.
Glossophaga mutica Merriam.

BIRDS.

Columba flavirostris madrensis Nelson.
Leptotila capitalis Nelson.
Buteo borealis fumosus Nelson.
Polyborus cheriway pallidus Nelson.
Psittacula insularis Ridgway.
Trogon ambiguus goldmani Nelson.
Dryobates scalaris graysoni Baird.
Nyctidromus albicollis insularis Nelson.
Amazilia graysoni Lawrence.
Iache lawrencei Ridgway.
Platypsaris aglaiæ insularis (Ridgway).
Myiopagis placens minimus Nelson.
Icterus graysoni Cassin.
Cardinalis cardinalis mariæ Nelson.
Piranga bidentata flammea (Ridgway).
Vireo flavoviridis forreri (Von Madarasz).
Vireo hypochryseus sordidus Nelson.
Compsothlypis insularis (Lawrence). Occurs also on the mainland near San Blas.
Granatellus francescæ Baird.
Thryothorus lawrencii (Ridgway).
Thryothorus lawrencii magdalenæ Nelson.
Melanotis cærulescens longirostris Nelson.
Myadestes obscurus insularis Stejneger.
Merula graysoni Ridgway.

REPTILES.

Cnemidophorus mariarum Günther.

FLORA.

The islands were visited near the end of the long dry season, when most of the herbaceous plants were withered and lifeless, but representatives of 136 species, largely shrubs and trees, were secured.

The general appearance of the vegetation was the same as that in similar situations on the mainland. Among the most notable plants were the Spanish cedar (*Cedrela*), three species of wild fig (*Ficus*), two of *Pithecolobium*, five of *Solanum*, two of *Ipomœa*, a *Passiflora*, cassias, euphorbias, a large agave, a large cereus, and two opuntias.

On San Juanito the vegetation is largely made up of bushes and scrubby trees 8 to 15 feet high, with many agaves on the sandy southern end. Agaves are very numerous also on the northern end of Maria Madre. On the latter island the forest is rather low and scrubby near the shore, but increases in luxuriance farther up the slopes, especially along the bottoms and sides of the canyons, where Spanish cedars, wild figs, and several other trees attain a large size. In its primeval condition, before the advent of woodcutters, it must have presented a fine example of tropical forest growth. Now, only a few specimens remain to show what the original condition must have been. Along the summit of the island the dense forest is made up of slender-trunked trees, called 'palo prieto' by the natives, which I was unable to identify. On Maria Magdalena the conditions were similar to those on Maria Madre, but a larger percentage of the original forest still remains intact, although the Spanish cedars are mainly gone. Maria Cleofa is more rocky and sterile, and the trees are stunted and brushy. Several species found on the other islands appeared to be wanting here. The report on the plants shows that the flora of the islands is very similar to that of the mainland, and the fact that several new species were found may be due to our imperfect knowledge of the mainland flora.

PLANTS DESCRIBED FROM THE TRES MARIAS.

Ægiphila pacifica Greenman.
Beloperone nelsoni Greenman.
Buxus pubescens Greenman.
Cordia insularis Greenman.
Erythrina lanata Rose sp. nov. (also on mainland).
Euphorbia nelsoni Millspaugh.
Euphorbia subcœrulea tresmariæ Millsp. var. nov.
Gilibertia insularis Rose sp. nov.
Pilocarpus insularis Rose sp. nov.
Ternostroemia maltbya Rose sp. nov. (also on mainland).
Zanthoxylum insularis Rose sp. nov.
Zanthoxylum nelsoni Rose sp. nov.

SUMMARY.

The following statement shows the number of species of animals and plants now known from the Tres Marias:

Land mammals	11
Birds	83
Reptiles	18
Fresh-water fish	2
Fresh-water shrimp	1
Land mollusks	6
Plants	136

ACKNOWLEDGMENTS.

Much of the value of this report is due to the cordial cooperation of several eminent specialists. Through the courtesy of Mr. F. V. Coville, curator of the National Herbarium, Dr. J. N. Rose, assistant curator, was enabled to prepare the report on the plants. Dr. Leonhard Stejneger, curator of the division of reptiles of the National Museum, Dr. William H. Dall, honorary curator of the division of conchology, and Miss Mary J. Rathbun, assistant in the division of invertebrates, reported on the Tres Marias material; and Prof. B. W. Evermann, ichthyologist of the United States Fish Commission, kindly identified the collection of fishes from the islands and the adjacent mainland. Finally, I wish to express my great indebtedness to Mr. Robert Ridgway, curator, and Dr. Charles W. Richmond, assistant curator, of the division of birds in the National Museum, for having so freely placed at my disposal, not only the material in their charge but also their knowledge of tropical American birds.

MAMMALS OF THE TRES MARIAS ISLANDS.

By E. W. Nelson.

Mammals are not numerous either in species or individuals upon the Tres Marias. So far as known, they number but eleven species, of which seven are peculiar to the islands; one is introduced, and the other three are widely ranging bats. A sea lion and two species of porpoise were found near the shores, and whales were reported to occur during certain seasons. As with the birds, one of the most unaccountable features of the mammal fauna is the absence of a number of species that are common on the adjacent mainland. Considering the primitive condition of the islands, it is difficult to explain the presence of field mice, the pigmy opossum, rabbit, and raccoon, while the large gray opossum, nasua, skunk, fox, coyote, deer, peccary, squirrel, and various small rodents of the adjacent mainland remain unrepresented. The Tres Marias mouse was rather common above 200 feet on all of the larger islands; the rabbit was very numerous near the north end of Maria Madre, on San Juanito, and in some places on Maria Magdalena, and two species of bats were abundant in caves on Maria Madre. Aside from these species, mammals were uncommon and difficult to find. One cause of their general scarcity may be the very limited supply of permanent fresh water, and the absence of small species from a broad belt near the shore was easily accounted for by the abundance of carnivorous crabs.

The mammals obtained by our party have been identified by Dr. C. Hart Merriam, who has described the new forms and given critical notes on other species.[1] Of the land mammals taken, five were new and two, *Lepus graysoni* and *Rhogeëssa parvula*, had been previously described. We failed to secure two species of bats (*Myotis nigricans* and *Lasiurus borealis mexicanus*) which were taken by Mr. Forrer. Notwithstanding the fact that collections were made in several branches of natural history, I feel confident that representatives of all the resident land mammals were secured, but it is quite possible that future work may add other bats to the present list.

ANNOTATED LIST OF SPECIES.

Marmosa insularis Merriam. Tres Marias Pigmy Opossum.

Marmosa insularis Merriam. Proc. Biol. Soc., Washington, XII, pp. 14–15, Jan. 27, 1898. Type from Maria Madre Island.

These pretty little opossums were not found except in the high interior of Maria Madre, between 1,200 and 1,800 feet above sea level, where they were apparently rather common about the wild fig trees in the forest and were feeding upon the figs. They may occur also on the other islands, especially upon Maria Magdalena. Two men living on the island described the nests of these animals as globular masses of dry leaves and small plant stems, lined with shreds of softer vegetable matter. The nests are built in the forks of bushes, from 3 to 8 feet from the ground, and have the entrance on the lower side. One of the men found a nest situated as described and about 3 feet from the ground. He saw the owner peering out of a hole near the lower side, but as he approached the head vanished, and the entrance was suddenly closed by the opossum drawing some of the nest material across it. The nest was quickly thrust into a game bag, and when examined was found to contain a female opossum and a number of young clinging to her fur with their feet and tails twined closely about hers. The weight of the young was so great that the parent could only walk very slowly.

---

[1] Proc. Biol. Soc. Washington, XII, pp. 13–19, 1898.

Oryzomys nelsoni Merriam. Nelson's Rice Rat.

Oryzomys nelsoni Merriam. Proc. Biol. Soc. Washington, XII, p. 15, Jan. 27, 1898. Type from Maria Madre Island.

This rice rat is probably a rare species, as only a few specimens were secured after much trapping. They were found only in damp places near springs about the summit of Maria Madre, about 1,800 feet above sea level. This seemed the most suitable location for them on account of the juicy herbaceous vegetation mingled with the undergrowth.

Peromyscus madrensis Merriam. Tres Marias Mouse.

Peromyscus madrensis Merriam. Proc. Biol. Soc. Washington, XII, p. 16, Jan. 27, 1898. Type from Maria Madre Island.

This is the mostly widely distributed and probably the most numerous rodent. Specimens were taken on the three large islands, but its occurrence on San Juanito, where land crabs are very numerous, is doubtful. They were generally distributed over the forest-grown slopes bordering the shore, above the belt infested by crabs. On Maria Madre they were most common about the wild fig trees near the summit (1,500 to 1,800 feet), where the pigmy opossums were secured. Here their burrows entered the ground under logs or projecting roots, but elsewhere these mice were found living beneath rocks and small ledges. They are apparently restricted to the forest, and while nowhere so abundant as were the rabbits in one place near the north end of Maria Madre, yet they were much more generally distributed.

Mus rattus Linn. Black Rat.

These rats were found in small numbers about the houses and distributed over the forested parts of Maria Madre and, as on the mainland of western Mexico, we found only the gray form.

Lepus graysoni Allen. Tres Marias Cottontail.

Lepus graysoni Allen, Mon. N. Am. Rodentia, pp. 347–348, 1877. Type from Tres Marias Islands (undoubtedly from Maria Madre).

The cottontail is abundant in some places on San Juanito, Maria Madre and Maria Magdalena, and was reported to occur on Maria

Cleofa. They were very numerous about a deserted ranch on the north side of Maria Magdalena, but were rather scarce elsewhere on that island. We found them extraordinarily abundant and surprisingly tame about old fields on an abandoned ranch at the northern end of Maria Madre. Some were killed with stones near camp, and it would have been easy to kill over a hundred in a morning. They would sit in their forms among the bushes while one peered at them from a distance of a few feet, and when driven out into an open space they often sat quietly while the camera was brought up and focussed within a short distance. The old fields at this ranch had been long abandoned and were covered with a scattered growth of bushes, which seemed more suitable for the rabbits than the forested areas, where they occurred much more sparingly. The cottontails frequented the wood roads leading from the shore up over the forested slopes, and after 3 o'clock in the afternoon could be found sitting quietly in little open places in the undergrowth waiting for the nearer approach of sunset before coming out into the roads.

The skin of these rabbits was surprisingly delicate, and it was difficult to skin them without tearing it in many places. It was found almost impossible to carry a specimen by the hind legs even a short distance without having the skin tear and slip where it had been grasped by the hand.

It is strange that the rabbits are not more abundant on the islands, considering the fact that the raccoon is the only predatory mammal, and that the few red-tailed hawks and caracaras are the only birds that prey upon them.

Procyon lotor insularis Merriam. Tres Marias Raccoon.

Procyon lotor insularis Merriam. Proc. Biol. Soc. Washington, XII, p. 17, January 27, 1898.

The raccoon was rather common on Maria Madre and Maria Magdalena, but no signs of them were seen on Maria Cleofa, where, however, they may occur. In May they were feeding on wild figs and other fruits and on the crabs, which were very abundant near the shore. Every morning freshly made raccoon tracks were seen in trails leading from the seashore to higher parts of the islands, but the animals usually passed our traps without paying the slightest attention to the bait. They were semi-diurnal in habits and several were seen in the woods in broad daylight. One afternoon one was seen crossing the bed of a dry wash near the northern end of Maria Madre, and instead of trying to escape through the woods it climbed a wild-fig tree on the bank and stood looking down from a horizontal branch until shot.

Zalophus californianus (Lesson). Sea Lion.

A large seal or sea lion, called 'lobo marino' or sea wolf by the Mexicans, was reported to occur at several places on the rocky shores of Maria Magdalena and Maria Cleofa. We first heard of them before leaving San Blas and again upon reaching the islands. It was evident that the sea lions had been hunted for sport by previous visitors until they had become comparatively scarce and are now in a fair way to become extinct. After learning the location of the most frequented places on both islands, we visited them under the guidance of a tortoise-shell hunter who was very familiar with the shore, but we saw only a single sea lion. It was on a rocky islet off the shore of Maria Cleofa, and took to the water and disappeared before we could get a shot. Our guide said that sometimes the sea lions leave the islands for a few days, and this may account for the failure to find them about their usual haunts. The consensus of opinion among the residents of Maria Madre was that these animals are now very scarce. Formerly they were found in many places; but at present a rocky point on the north-west side and a jutting reef on the south side of Maria Magdalena and some islets west of Maria Cleofa are the only landing places used.

It is possible that the Guadalupe Island fur seal (*Arctocephalus townsendi* Merriam) may also occur at times about the islands.

Rhogeëssa parvula H. Allen. Tres Marias Rhogeëssa.

Rhogeëssa parvula H. Allen. Proc. Acad. Nat. Sci. Phila., 1866, p. 285. Type from the Tres Marias.

These little bats were rather common on Maria Madre, where they live in the forest and fly at dusk along the trails and about small open places. At times they appear in such situations in broad day. Two were killed while flying up and down a trail in the brilliant sunshine in the middle of the forenoon, and I saw one hawking for insects among the tree tops along a trail two hours before sunset. As a rule, however, they only come out when it is too dark for one to see more than an indistinct form as they flit about among the trees. A few were also seen on Maria Magdalena.

Myotis nigricans (Maximilian). Maximilian's Black Bat.

According to Mr. Oldfield Thomas, a specimen of this bat was taken on the Tres Marias by Mr. Forrer.[1] We took none, and they probably occur on the island only as stragglers.

Otopterus mexicanus (Saussure). Big-eared Bat.

A colony of over a hundred big-eared bats was living in an old warehouse at the settlement on Maria Madre, and others were found in several caves situated in various parts of the island. The warehouse where these bats were found had a large open window and wide cracks, so that it was quite light inside, yet they were found hanging from the ceiling and roof, in plain view, and evidently had lived there a long time. The specimens were mostly females heavy with young.

Glossophaga mutica Merriam. Tres Marias Glossophaga.

Glossophaga mutica Merriam. Proc. Biol. Soc. Washington, XII, pp. 18–19, January 27, 1898. Type from Maria Madre Island.

This was by far the most numerous bat on Maria Madre, where it was found in every cave sufficiently deep to be dark. One cave was among some huge projecting rocks lying at the water's edge, near the settlement. Many of the females collected contained large embryos. These bats were feeding on the fruit of the wild fig.

---

[1] Biologia Centrali-Americana, Mammalia, 206, 1881 (under *Vespertilio nigricans*).

As surmised by Dr. Merriam,[1] the record of *Chœronycteris mexicana* from these islands, given by Mr. Thomas in the Biologia, proves to be referable to the present species. In reply to a letter of inquiry, Mr. Thomas states that he discovered the mistake in identification too late to correct it in the Biologia, and agrees with Dr. Merriam in referring his specimen to *G. mutica.*

Lasiurus borealis mexicanus (Saussure). Mexican Red Bat.

Forrer added this species to the fauna of the Tres Marias as recorded by Mr. Thomas.[2] We did not see any red bats, and I doubt their being found on the islands except as stragglers from the mainland. Bats are such wide-ranging animals it is to be expected that several additional species will eventually be found to occur on the islands.

? **Phocæna communis** (Lesson). Common Porpoise.

Porpoises supposed to belong to this species were common around the shores of the Tres Marias and also in bays and mouths of streams or lagoons along the coast of the mainland. They were always seen in the belt of shallow discolored water within a short distance of the shore. As soon as blue water, with a depth of over 40 fathoms, was reached, the other porpoise (*Prodelphinus longirostris*) was encountered. The common porpoise was seen in schools of 10 to 30 or 40 individuals swimming in loose order. At Maria Madre they came into the shallow bay in front of the settlement in the early morning and followed close along shore.

Prodelphinus longirostris (Gray). Long-nosed Porpoise.

In the blue water between the mainland and the islands these porpoises were very abundant in schools of from 100 to 200 individuals. They are much slenderer and more graceful animals than the preceding species. While swimming about their feeding places at sea they were accompanied by swarms of terns, gannets, and shearwaters. On one occasion, while crossing to the islands, a school of about 200 porpoises came directly toward us and passed under and on all sides of the boat. While they were passing, the water was broken into foam on every hand by their glistening black bodies, and overhead swarmed a shrieking crowd of sea birds. Mr. Goldman made a fortunate rifle shot and killed two of them, but one sank before it could be harpooned.

---

[1] Proc. Biol. Soc. Washington, XII, pp. 13–19, footnote, January, 1898.

[2] Biologia Centrali-Americana, Mamm., p. 205, footnote.

BIRDS OF THE TRES MARIAS ISLANDS.

By E. W. Nelson.

The present paper is based mainly upon the birds found on the Tres Marias, but for the sake of completeness the results of our work on Isabel Island have also been introduced.[1] The situation of Isabel Island between the mainland and the Tres Marias renders its bird life of peculiar interest in the present connection. Mr. Xantus sent specimens of birds to the National Museum labeled 'Tres Marias, 1861,' but only one of these can be an authentic island species, and it seems almost certain that Xantus did not visit the islands.

Colonel Grayson's notes on his three visits to the group and his trip to Isabel Island were published by George N. Lawrence in the 'Proceedings' and 'Memoirs of the Boston Society of Natural History,' while the descriptions of new birds in his collections appeared in various publications and are mentioned in the bibliography (see pp. 93–94). Grayson constantly refers to the 'Tres Marias Islands,' but the internal evidence of his writings, in addition to the information given me by the inhabitants, indicates that all of his work was done on Maria Madre.

Mr. A. Forrer visited Maria Madre in 1881, but the publication of *Vireo flavoviridis forreri* by Von Madarasz and a few notes in the 'Biologia Centrali-Americana' and in some of the British Museum Catalogues are all we know of his work there.

As already stated in the general introduction, our work was done on Isabel Island on April 22 and 23, on Maria Madre from May 2 to 25, and six days were spent working about Maria Magdalena and Maria Cleofa. It is quite certain that the bird fauna of Maria Madre is now fairly well known, and it will be advisable for anyone visiting this group in the future to give attention chiefly to the two smaller islands. It is certain that a large proportion of the birds found on Maria Madre occur also on Maria Magdalena, but some of the species living in the dense forest at higher altitudes on these islands probably do not occur in the more scanty forest of Maria Cleofa.

At present 83 species and subspecies of birds are known from the Tres Marias, and further observations will, no doubt, add to the list various stragglers from the mainland. The bird fauna may be grouped under the following headings: Resident land birds, 36 species or subspecies. Visitant land birds, 26 species or subspecies. Resident water fowl, 13 species. Visitant water fowl, 8 species.

---

[1] The notes in the following pages refer to Isabel Island only when so stated.

Of the 36 resident species or subspecies of land birds all but 5 were observed by Colonel Grayson. These exceptions are: *Melopelia leucoptera*, *Tyrannus melancholicus couchi*, *Ornithion imberbe*, *Vireo flavoviridis forreri*, *and Thryothorus lawrencii magdalenæ*.

Twenty-four of the 36 resident land birds are specifically or subspecifically distinct from their mainland representatives. Of this number 12 were described from Grayson's collections, 1 from Forrer's, and 11 from our own. A study of our collections from the islands, and near San Blas on the mainland, brings out the interesting fact that several species from the latter district show a decided approach to their island representatives. This is very marked in *Compsothlypis* which is very nearly the same at San Blas as on the islands. The *Polyborus* and *Platypsaris* from that locality seem to be intermediate between the island races and the birds of the mainland. Specimens of *Thryothorus felix* from the same part of the coast are much nearer *T. lawrencii* than they are to typical *T. felix*.

Among the 24 species or subspecies of land birds peculiar to the islands 15 are larger than their relatives of the nearest mainland. These are *Columba f. madrensis*, *Leptotila capitalis*, *Psittacula insularis*, *Dryobates s. graysoni*, *Nyctidromus a. insularis*, *Amazilia graysoni*, *Icterus graysoni*, *Cardinalis c. mariæ*, *Piranga b. flammea*, *Vireo f. forreri*, *Vireo h. sordidus*, *Compsothlypis insularis*, *Granatellus francescæ*, *Thryothorus lawrencii* and *Merula graysoni*.

Six of the island birds average smaller than their mainland representatives. These are *Polyborus c. pallidus*, *Iache lawrencei*, *Platypsaris a. insularis*, *Myiopagis p. minimus*, *Melanotis c. longirostris*, and *Trogon a. goldmani*. The two first named are generally smaller, but *Platypsaris a. insularis* has a longer tarsus, *Myiopagis p. minimus* a longer bill and tarsus, *Melanotis c. longirostris* a longer bill, and *Trogon a. goldmani* a longer bill and tarsus.

Although *Compsothlypis insularis* also occurs in a limited area along the coast, I have considered it as a typical island species. The difference in size between island birds and their mainland representatives varies greatly, being slight in some and very well marked in others. *Nyctidromus a. insularis* is a larger bird than *albicollis* proper, but has a shorter bill and tarsus. Among the birds peculiar to the islands *Thryothorus lawrencii magdalenæ* and *Myadestes o. insularis* are almost the only ones which do not show more or less well-defined differences in size from their nearest mainland relative; a series of the first named, however, may show that it also differs.

One of the most puzzling features of the fauna of these islands is the absence of various land birds found on the adjacent mainland. Although the physical conditions appear so much like those of the mainland, yet some change must have occurred to upset nature's fine balance and render these isolated areas unsuitable for many species.

The death by starvation of the Louisiana Tanagers on Maria Madre Island (p. 52) is an example of the manner in which the island fauna may be maintained in its present state. As the climatic conditions on the islands and on the mainland are very similar and the vegetation nearly alike, this paucity of species presents one of the curious problems of distribution.

It would be hard to find an equal area of similar country on the mainland, near San Blas, where so few species of land birds could be found. The only reasonable explanation seems to be the scarcity of water and the long, dry season, which combine to reduce the food supply and perhaps render the country unsuited to some species. It was very surprising to find a total absence on the islands of such common and widely spread mainland genera as *Conurus*, *Momotus*, *Piaya*, *Campephilus*, *Melanerpes*, *Myiozetetes*, *Cissolopha*, *Cyanospiza*, *Pipilo*, *Pyrgisoma*, *Saltator*, and others. The absence of *Pipilo* is especially unexpected, for this genus is represented on Socorro Island, which lies very much farther at sea off the same part of the coast.

ANNOTATED LIST OF SPECIES.

? **Brachyrhamphus brevirostris** (Vigors.) Short-billed Murrelet.

Brachyrhamphus brevirostris was described from San Blas and *B. hypoleucus* from Cape St. Lucas. Colonel Grayson mentions having seen 'guillemots' at Isabel Island (Mem. Boston Soc. Nat. Hist., II, p. 318, 1874) and off the Tres Marias group (Proc. Boston Soc. Nat. Hist., XIV, p. 288, 1871). This led me to anticipate finding at least one of the species there, and it is with some disappointment that I have to record our failure to see either species about the islands, although I watched for them constantly. From this experience I am inclined to think that they breed only along the coast of Lower California, and visit these islands sporadically.

Larus argentatus smithsonianus Coues. American Herring Gull.

A single immature specimen was taken on San Juanito Island May 22, and a few others were seen. These birds were flying back and forth along a strip of beach where a large colony of blue-footed gannets were breeding, and the gulls probably had an eye on the nesting ground for the purpose of capturing any unprotected eggs. They were noted singly a few times along the shores of the Tres Marias and at Isabel Island. No fully adult individuals were seen.

Larus heermanni Cassin. Heermann's Gull.

On April 23 a fine adult bird of this species was shot on the shore of Isabel Island. In company with its mate it had harried a blue-footed gannet into disgorging a number of small fish upon a rock at the edge of the water, and was picking up the spoils by a series of little downward swoops and hoverings. The gannet had shuffled into the water and was making off, with backward glances at its tormentor, when I drew near. These gulls are bold and noisy aggressors when they wish to take advantage of the gannets, and about the breeding places of the latter they feed largely at the public expense. But few of them were seen about the islands—two or three pairs at Isabel and half a dozen pairs about the Tres Marias. A nest, which had been occupied earlier in the season, was seen on the ledge of a rocky islet off the shore of Maria Cleofa May 30, and full grown young of the year were also seen on the rocks.

Sterna maxima Boddaert. Royal Tern.

None were seen at Isabel Island, although they were not uncommon during April along the mainland coast. During May they were seen in small parties about the shores of all the Tres Marias group, where they probably breed in very limited numbers. The only specimen saved was taken May 31 from a flock of six which was coasting along the beach at Maria Cleofa.

Sterna elegans Gambel. Elegant Tern.

Sterna galericulata Lawr., Mem. Boston Soc. Nat. Hist., II, p. 317 (1874).

Colonel Grayson found these terns on Isabel Island, but none were seen by us.

Sterna fuliginosa crissalis (Lawr.). Pacific Sooty Tern.

Haliplana fuliginosa var. *crissalis* Lawr. (ex Baird MS.), Proc. Boston Soc. Nat. Hist., XIV, pp. 285, 301, June, 1871; Mem. Boston Soc. Nat. Hist., II, p. 318, 1874.

These handsome terns are common about Isabel Island where Colonel Grayson found them breeding. My observations from the last of April to the first of June led me to believe that at this season Isabel Island is their central roosting point. During the week we were cruising about Isabel and the Tres Marias islands many flocks were seen. From about noon until the middle of the afternoon or later the flocks were generally flying directly toward Isabel at an altitude of from 50 to 200 yards above the water. This was noted also near the islands, while we were crossing the straits between the Tres Marias, and off the mainland near San Blas. Many of the birds were perched along the top of an inaccessible rock just off Isabel, and were also seen alighting on the cliffs of the northern and northeastern side of the island, but the boat was too unwieldy for us to venture near enough to closely examine these haunts. The birds have a peculiar shrill cry which they often utter while feeding and when flying about at night. The night before we landed on Isabel Island it was necessary to anchor about midway between the island and the shore. The wind blew strongly in the afternoon but fell at sunset, a dead calm ensued, and heavy clouds overspread the sky. During the day only a few sooty terns had been seen, but from about 9 p. m. until near daybreak they were evidently much more numerous, for their cries were heard at short intervals. Several times the notes were uttered directly overhead and the birds seemed to be scarcely higher than the top of the mast, where they apparently paused and hovered while they examined the boat with great curiosity. As they were heard every night while we were at sea, it is evident that they were both diurnal and nocturnal in habits.

They feed well out at sea, and were not found anywhere along shore, except when they came to their roosting place on Isabel Island. There were no signs of their roosting about the Tres Marias, although they may roost on some of the outlying rocky islets. Grayson found them in small numbers farther west, about the Revillagigedo Islands. During our trip to the Tres Marias many schools of large fish were encountered swimming close to the surface and constantly breaking, often with such force and rapidity that the water boiled and foamed over considerable areas. These schools of fish were commonly accompanied by flocks of sooty terns and gannets, which appeared to be animated by the wildest excitement. The terns hovered over the foaming sea, uttering shrill cries and darting down into the water, evidently after food; and in the midst of the turmoil the blue-footed gannets swam about, beating the water with their wings and adding to the noise made by the terns and leaping fish. While on Maria Madre I saw a flock of terns some distance off shore, and taking a canoe, managed to get out to them, and directly in the course of the school of fish they were accompanying. Letting the boat drift, I stood up and watched the swarm go by. Thousands of large fish and hundreds of terns and gannets passed the boat on every side, amid loud cries from the terns, a rushing sound from the fish and gannets, and a bewildering complexity of motion in sea and air that was intensely exciting. This novel sight was so interesting that I came near losing the chance to secure some of the birds.

These terns were seen also following schools of porpoises off shore—in the latter case accompanied by the wedge-tailed shearwater. In the passage between Maria Magdalena and Maria Cleofa a flock of sooty terns was seen soaring in wide circles high overhead and finally starting off for their roosting place on Isabel Island.

The 'variety *crissalis*,' named in manuscript by Professor Baird and published by Mr. Lawrence, was characterized as "having the under tail coverts tinged with ashy, instead of being pure white." A series of 17 specimens from the west coast of Mexico, and from widely scattered islands of the Pacific and Indian oceans, agree in having the posterior part of flanks, under wing coverts, and entire crissum distinctly ashy, not a single individual being white on these parts, as is commonly the case with birds from the Atlantic and Gulf coasts of North America. Unfortunately the series of Atlantic birds at hand is very small, but there is little doubt that *crissalis* is a valid subspecies. Birds from the west coast of Mexico, the Galapagos Islands, and Hawaii agree in having an average shorter bill and tail than those from elsewhere. Specimens from the Indian Ocean have even a longer bill and tail than those from the Atlantic, but are ashy below, like those from western Mexico. Specimens from Ascension Island, off the west coast of Africa, also have a light ashy shade on the lower tail coverts.

The following average measurements show the sizes of these birds from various parts of their range:

*Table of measurements of Sterna fuliginosus and Sterna f. crissalis.**

Name.	Locality.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Sterna fuliginosus ..	East coast of North America and west coast of Africa.	7	288.1	151	42.8	23.5
Sterna fuliginosus crissalis.	West coast of Mexico, Hawaii, and Galapagos Islands.	10	288.6	143.5	41.8	23.6
Sterna fuliginosus crissalis.	Krusenstern Islands (west of Hawaii).	2	292.5	203.5	39.5	24.2
Sterna fuliginosus crissalis.	Glorioso Island (Indian Ocean)	3	292.6	192	43.3	23.8

* All measurements are in millimeters.

In the foregoing measurements the length of the tail is unreliable, owing to its variability, on account of wear and other causes.

Anous stolidus ridgwayi Anthony. Pacific Noddy Tern.

Anous stolidus Lawr., Mem. Boston Soc. Nat. Hist., II, p. 318, 1874.

Anous stolidus ridgwayi Anthony, Auk, XII, p. 36, 1898.

Common the last of April on Isabel Island, and a few seen off the Tres Marias during May. Between San Blas and the islands a number of these birds were seen. We usually saw one or two individuals at a time, and did not find them in flocks anywhere except when congregated on the rocks at their roosting places. At sea they usually flew close along the surface of the waves with long, graceful wing strokes. From their dark color and habit of keeping close to the water they were several times mistaken for black petrels.

They were found in considerable numbers on the ragged faces of cliffs and rocks along the northeastern point of Isabel Island, and were very unsuspicious, permitting us to approach quite near in the boat. While perched on the black lava cliffs, their dark color blended so closely with the background that it was very difficult to distinguish them, even when within fair gunshot. The day we left the island we visited their resting place and fired a dozen or more shots while they were on the rocks or flying about, but the noise of the reports did not seem to give them much alarm. They would circle out a short distance, and, after hovering for a few moments over their killed or wounded companions floating in the water, would return to the same part of the cliff from which they had just been startled. They were not heard to utter any notes, and the silence with which they would suddenly appear out of the cliff and then return and vanish again in its gloomy face produced an uncanny effect.

Colonel Grayson found them nesting on the north end of Isabel Island in April, 1869, and states that they were breeding in communities on shelving rocks beneath overhanging cliffs. The nests were placed close together, but were inaccessible. A single egg was procured, however, which was white, with scattering brownish blotches, most numerous about the larger end. This is undoubtedly the tern which Colonel Grayson reports as replacing the sooty tern on the Revillagigedo Islands, and which he described as being black, with a hoary forehead.

Puffinus cuneatus Salvin. Wedge-tailed Shearwater.
Puffinus cuneatus Salvin, Ibis, 5th ser., VI, p. 353, July, 1888.
Puffinus knudseni Stejn., Proc. U. S. Nat. Mus., XI, p. 93, Nov. 8, 1888.

During our trip to and from the islands we saw 100 or 200 wedge-tailed shearwaters. They were usually seen singly skimming along over the sea, at an elevation af a few yards, making widely sweeping circuits and pausing occasionally to pick up bits of food. When about midway between Isabel Island and the Tres Marias we encountered several schools of small porpoises of 150 or more individuals, which traveled in close array, frequently gamboling about and playfully leaping high in the air. A swarm of sooty terns followed the porpoises, and twice when they passed near us I saw considerable numbers of these shearwaters among the terns. Judging from the numbers, they must be rather common in these waters, but none were seen near the islands.

This species was first described from specimens taken on the Krusenstern Islands, in the Marshall Group, and Mr. A. W. Anthony made the first record of its occurrence on the American side of the Pacific, at the Revillagigedo Islands, during the summer of 1897 (Auk, XV, Jan., 1898, p. 39). As it is a species new to North America, a detailed description of our specimen is given, in order to facilitate identification in case other examples should be taken.

Description.—No. 156678, U. S. Nat. Mus., Dept. of Agriculture Coll. Ad. ♂, off Maria Mandre Island, May 2, 1897. Collected by E. W. Nelson and E. A. Goldman.

Top and sides of head and neck grayish-brown; forehead, lores, and space from latter area back beneath eyes and along sides of neck paler or more ashy, thus edging the darker area of the crown and upper neck with lighter. Back, including rump and upper tail coverts, mainly dark brown, but mixed with numerous feathers of a decidedly grayish, almost ashy, shade. These latter feathers undoubtedly indicate the color of dorsal surface in fresh-plumaged birds. Wings and tail blackish-brown. Entire lower surface of body white, shaded with dingy ashy, darkest on sides and palest along median portion. Under tail coverts mixed dark brown and grayish-brown. Border of the wing along under side brown or grayish-brown; under coverts white with a little flecking of pale gray on some feathers. In the flesh this specimen had a horn-blue bill with flesh-colored feet and tarsi.

Dimensions.—Wing, 293; tail, 135 (length of middle pair of tail feathers beyond lateral pair, 47); culmen, 42; tarsus, 50; middle toe, with claw, 59.

Habitat.—The range of this species is now known to extend across the middle North Pacific from Japan to the west coast of Mexico.

Oceanodroma melania (Bonap.). Black Petrel.

Common between Isabel and the Tres Marias. Black petrels were by far the most numerous of the petrels seen, and outnumbered all the others two to one. Three, and possibly four, other species were seen on the way to and from the islands, but this was the only one secured. They circled about in all directions, sometimes coming very near, but nothing peculiar in their habits was observed. They were quick to see little fragments of fat thrown overboard while we were skinning other waterfowl, and when the morsels were small enough ate them greedily.

Phæthon æthereus Linn. Red-billed Tropic Bird.

Tropic birds are readily distinguished on the wing by their graceful ternlike flight and long filamentous tail feathers. Many of them breed on Isabel Island and in suitable places on rocky islets near San Blas and about the Tres Marias. The last of April fresh eggs and nearly grown young were found on Isabel, and by the last of May the young on the Tres Marias had taken wing and few were to be seen, although we were told by the tortoise shell hunters that many breed there earlier in the season.

Soon after landing on Isabel, a tropic bird was found sitting on its solitary egg at the end of a little hole in the rock close to the beach. The hole was only about 15 or 18 inches across and about 3 feet deep, so that there was no difficulty in taking the bird by hand after a little maneuvering to avoid its sharp beak. During a stay of about twenty-four hours on this island at least 20 nests containing eggs or young were examined. A single egg is laid directly on the rough rock or loose dirt forming the floor of the nesting site, which is always located under the shelter of over arching rock, but varies greatly in situation. The inner ends of holes in cliffs facing the sea were favorite places, but as the number of such situations was limited, the birds were forced to utilize small caves and even rock shelters. In one locality five or six nests were placed on loose earth at the bottom of rock shelters so situated that I could walk directly up to them and pick up the birds. Whenever a nest was approached the parent screamed and fought viciously, ruffled its feathers and looked very fierce, but made no attempt to escape. They protested with beak and voice when pushed about, but as soon as I went away a few yards they would shuffle back to resume their former position over the egg. The young, even when quite small, were equally fierce in resenting any intrusion. One nest was found on the beach under the edge of some great rocks that had fallen from the adjacent cliff. It was only 5 or 6 feet above high tide and would have been overlooked but for the angry cries of the old bird when she heard me walking over the roof of her habitation. At sunrise the old birds were found sitting side by side at the mouths of their nesting places waiting to enjoy the first rays of sunlight. Half an hour later one of each pair started out to sea while the other resumed its place on the nest. When disturbed on the nest their cries are very shrill and strident, consisting of a series of short, harsh, clicking or rattling sounds something like the noise of an old-fashioned watchman's rattle. The young are covered at first with fluffy white down. Before they are one-third grown the first plumage begins to appear, and is very similar to that of the adults, except that the black barring on the back is broader.

Sula websteri Rothschild. Webster's Booby.

Sula bassana Grayson, Proc. Boston Soc. Nat. Hist., p. 302, 1871.

Sula websteri Rothschild, Bull. Brit. Orn. Club, VII, No. LIV, p. LII, 1898.

This booby is no doubt the *Sula bassana* reported from Isabel Island by Grayson but not seen by us. Mr. Anthony found it the most abundant species breeding on the Revillagigedo Islands during the summer of 1898.

Sula brewsteri Goss. Brewster's Booby.

Sula brewsteri Goss, Auk V, p. 242, 1888.

Brewster's boobies were very numerous on a small hill at one side of the little bay where we landed on Isabel Island April 22, but there were no signs of their breeding. They came in from sea during the first half of the afternoon and sat about on rocky parts of the shore until nightfall. Scattered individuals were also seen about the ledges and tops of the cliffs facing the sea. The following morning at daybreak they were congregated on the little hill already mentioned which is probably their regular roosting place. About half an hour after sunrise they began to start out to sea singly and by twos and threes until all were off on the day's fishing expedition. A few were seen about the rocks just off San Blas, and were said to breed on the large rock (Piedra Blanca) midway between Isabel and San Blas. Only a few of these boobies were seen about the Tres Marias until an islet was visited off the northwest shore of Maria Cleofa. This islet rises from 150 to 200 feet above the sea, with cliffs on all sides. The summit is mainly rolling, with an elevated, sloping bench on one end At this time, May 30, many thousands of boobies were breeding on the bare top of this rock. The eggs were laid directly on the surface, with no sign of a nest. The sun was intensely hot and heated the rocks so that they were uncomfortably warm to the touch. The birds did not sit upon the eggs during the hottest hours, but while standing to avoid contact with the heated rocks kept in such position that the eggs or young were shaded from the sun, and thus had their vitality preserved. While trying to secure photographs of this breeding ground a few of the old birds flew away and it was surprising to see how quickly the newly hatched young succumbed to the heat when the parents left them exposed to the rays of the sun. The nests were spaced at intervals of 4 or 5 feet, so that the old birds were safely out of reach of one another. Although so gregarious in their breeding habits, they appeared to have but little regard for one another. It was amusing to see the savage way in which the nest owners assisted intruders of their own kind out of their territory. While we were walking among them some of the birds would often waddle off to one side, and in so doing necessarily trespassed on their neighbors. The latter at once raised a hoarse shrieking and set upon the outsiders with wicked thrusts of their beaks, which continued until the victims took wing and escaped.

We were also subjects of this proprietary rage, and had our legs nipped every now and then, despite all efforts to walk circumspectly. Our progress over the breeding ground was accompanied by a wave of hoarse, nasal cries that sometimes became almost deafening. Many of the birds were valiant upholders of their rights and sturdily refused to leave their nests, which they defended vigorously, all the time uttering loud cries of rage.

These birds show very little individual variation in color. As the species is not well known the following descriptions are appended from specimens taken on Isabel and Maria Cleofa.

Adult male.—Nearly entire head white, shading gradually on posterior portion into drab of neck and then insensibly into dark, sooty brown of back. On lower side of neck the drab becomes darkest at posterior border, where it ends abruptly against the pure white of lower parts. Bill light horn color; gular pouch in life livid blue; feet greenish yellow—the latter varying in intensity.

Male in immature plumage.—Dorsal surface uniform dark brown, slightly paler than back of adult; entire lower surface still paler and more dingy brown. Feathers over much of body, especially about head, neck, and lower parts, narrowly edged with grayish brown, giving a faint wavy barring. Bill bluish horn color, with darker shade of same about base and on gular pouch; feet and tarsi dull fleshy yellow; iris greenish gray.

Adult female.—Head, neck all around, and back sooty brown; ventral surface below neck white. Bill light horn color; a spot of leaden bluish on lores; base of bill, gular pouch, feet, and tarsi grayish yellow; iris pale grayish.

Average measurements of these birds from Isabel Island are as follows: ♂ (5 specimens), wing 384.4; tail 189.6; culmen 93.6; tarsus 45.4; ♀ (5 specimens), wing 416.6; tail 192.8; culmen 96.6; tarsus 48.8.

Nestlings a few days old are covered with fluffy white down. A male bird of the previous year, which still retained the immature plumage, was taken at Isabel on April 23, and several others were seen.

Sula nebouxii Milne-Edwards. Blue-footed Booby.

Sula piscator Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 302, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 316, 1874.

Sula nebouxii Milne-Edwards, Ann. Sci. Nat., Paris (Zool.), 6ème sér., XIII, Art. 4, p. 37, pl. 14, 1882 (Chile).

Sula gossi Goss (ex Ridgway MS.), Auk, V, p. 241, July, 1888 (Gulf of Calif.).

Sula nebouxii is the most abundant species of booby occurring on Isabel and the Tres Marias. On April 22 they were breeding abundantly on the beaches and on a low flat area that covers a part of the former island. They were common on the grassy beach at the landing and thence back among the scrubby trees and bushes which form a scanty growth over the flat. They were most numerous on the open beach a little above high-water mark, but dozens of them were seen with their eggs farther back among the bushes. Like the preceding species, they fought and screamed savagely when approached. The males usually flew away, but the females remained to give battle over the nests, which were mere hollows in the earth, sand, or gravel. Not a single young one was seen in the hundreds of nests on Isabel.

The sun was excessively hot the morning of our arrival, and while the men were landing the outfit, ropes were fastened between the tops of some scrubby trees close to the beach and a piece of canvas spread for an awning, under which the baggage was placed. An old booby had her eggs in the sand within 3 feet of the edge of the sheltered area and stood her ground unflinchingly while the men were at work, keeping a wary eye on their movements and making vicious dabs whenever a leg came incautiously within reach. Having arranged camp, I went out exploring for an hour or so and returned with various specimens, including the egg of a tropic bird, and found that one of the boatmen had driven off the booby and thrown away her eggs. Wishing to test the bird's discrimination, I placed the reddish-brown egg of the tropic bird in the hollow where the two greenish-white eggs of the booby had been, and sitting under the awning began to prepare specimens. In the course of half an hour the owner of the despoiled nest returned and alighted 10 or 15 steps away near another deserted nest, gave a look at the eggs in it, walked to still another, looked at it, and then proceeded directly to her own nest and stopped. She looked about and then down at the nest. The presence of the single reddish-colored egg appeared to surprise her; she looked at it with one eye and then with the other as if in doubt. An instant later the feathers on her head and nape ruffled up and with a loud squawk of rage she suddenly dashed her beak again and again into the strange egg, breaking it to fragments in a moment. As soon as the egg was demolished she took wing and disappeared out to sea. There was no intention to sacrifice the tropic bird's egg in this experiment, so the booby carried off the honors.

About 10 o'clock the following night a visit was paid to the nesting boobies. The night was calm, and taking a lighted candle I walked out a short distance to an opening in the bushes where there were twenty or thirty nests. The females were found on their eggs with the males standing close beside them. When the strange visitor appeared in their midst the birds set up a continuous series of hoarse cries and, like so many moths, seemed to become fascinated by the light. They started up on all sides, and trooping within the circle of bright light, began to run around me in a ring about 20 feet in diameter. They ran in single file from right to left and presented a most ludicrous sight. Occasionally one fell on its breast, whereupon the others scrambled over the fallen bird until it regained its feet and rejoined the procession. One of the number was suddenly possessed with a desire to run around one of my legs, and, although seized by the head several times and tossed out among its companions, persisted in returning to the same place and continuing its gyrations. The next morning at daybreak the birds were seen standing in pairs by their eggs and remained in this position until about sunrise, or a little after, when all of the males went out to sea—usually in little parties of two to five or six. They returned between 1 and 3 o'clock in the afternoon, and a number of them flew directly to their mates and disgorged numerous small fishes which the females ate greedily. These observations seemed to show that the females did the incubating and the males provided the food. As the neighboring waters do not abound in small fishes, the boobies have to go in many cases from 10 to 30 miles to obtain their daily supply. During a visit to San Juanito Island, the latter part of May, many blue-footed boobies were found breeding on sandy beaches at the south end of the island; many of the young were hatched and some were more than half grown. Like the young of the tropic birds, the young boobies uttered angry cries and fought savagely when approached.

This species is found in Chile, on the Galapagos Islands, and north to the island of San Pedro Martir in the Gulf of California. The type of *Sula nebouxii* was obtained on the coast of Chile, and the type of *S. gossi* came from San Pedro Martir.

The sexes are alike in color, but when standing together the males may be readily distinguished by their smaller size and slenderer form. In life the bill is leaden horn color, with its base and the gular pouch leaden blue; the feet are bright blue. The downy young are pure white. Four specimens measure as follows: ♂ (1 specimen), wing, 410; tail, 219; culmen, 108; tarsus, 51. ♀ (average of 3 specimens), wing, 438; tail, 219; culmen, 109.6; tarsus, 56.

Phalacrocorax sp. Cormorant.

Two or three cormorants seen at a distance were the only ones noted during the trip. None were seen near Isabel nor on the rocks near San Blas.

Pelecanus californicus Ridgway. California Brown Pelican.

A few pairs of brown pelicans were breeding on Isabel Island the last of April. The nests were made of sticks and placed in the dense tops of the scrubby trees growing on the rocky inner slopes of the island. They were found about all of the Tres Marias, but usually occurred singly and were nowhere common. Two or three were seen fishing in the breakers alongshore at the north end of Maria Madre.

Fregata aquila (Linn.). Man-o'-war Bird.

Hundreds of man-o'-war birds were breeding on Isabel in April, and on approaching the island many were seen soaring over the rocky summit. The first shot caused hundreds of others to take wing, and in a few moments the air was swarming with them. They soared in constantly intersecting circles, until the sky seemed covered with their silhouetted outlines. So few had been seen alongshore near San Blas that it was an interesting and unexpected sight. Upon landing, numerous large, oval, and brilliantly red objects were seen in the tops of the dark-green bushes along the slopes. These proved to be the gular pouches of old male man-o'-war birds inflated to the size of a man's head, the brilliant red color of the distended membrane making them very conspicuous objects. It appeared to be a common custom of the birds to sit quietly on the top of a tree for a long time with the pouches thus distended and evidently serving as sexual ornaments. A few birds were seen circling high overhead with their pouches fully inflated, but as a general rule, when soaring, the pouches were closed.

The nests were built of sticks and placed in the tops of low trees and stout bushes from near sea level to the summit of the island. Three or four of these platform-like structures were found together in some of the larger bushes. Many of the young were hatched and, when able to stand alone, would do their best with voice and beak to resent our approach. The young are covered with white down until nearly half grown.

A few of these birds were also seen about the Tres Marias, and are said to breed on San Juanito, but were not common.

Ardea herodias Linn. Great Blue Heron.

A few solitary individuals were seen at various times during May along the beaches, and it is probable that a few pairs may breed on the islands. They were also noted by Colonel Grayson.

Ardea egretta Gmel. American Egret.

The American egret is another species noted by Colonel Grayson, which we did not see. It must occur merely as a straggler from the mainland.

Ardea candidissima Gmel. Snowy Heron.

Recorded by Colonel Grayson as a straggler, but not seen by us.

Nycticorax violaceus (Linn). Yellow-crowned Night Heron.

A dozen or more night herons were noted and a young bird was shot on a rock close to Isabel Island, where it must have strayed from the mainland. As Colonel Grayson found them on the islands and took specimens in immature plumage, it is very probable that they breed there in small numbers.

Totanus flavipes (Gmel.). Yellow-legs.

A single specimen was shot by Prof. C. L. Herrick on Maria Madre the middle of May.

Actitis macularia (Linn.). Spotted Sandpiper.

A few were seen along the shore on all of the islands, where they probably breed.

Several small flocks of another sandpiper were seen along shore on the islands; but although considerable energy was expended in their pursuit we failed to secure a specimen.

Ægialitis semipalmata Bonap. Semipalmated Plover.

Colonel Grayson took a single specimen of this plover. It was not seen by us and must occur only as a straggler.

Hæmatopus palliatus Temminck. American Oyster-catcher.

Rather common on the shores of the Tres Marias and Isabel, as well as along the coast of the mainland near San Blas. A series of ten oyster-catchers were secured and have been compared with four specimens of *Hæmatopus galapagensis*, one of *H. frazari*, and a number of typical *H. palliatus* (from the Atlantic coast of the United States and the West Indies).

All of the birds from the Tres Marias, Isabel Island, and the adjacent mainland were found to be surprisingly close to typical *palliatus*. As the Tres Marias are not far south of Lower California, the birds from the islands might naturally be expected to be nearly typical representatives of *H. frazari*. In reality about the only sign of gradation toward the latter form is the mixed black and white across the lower border of the black neck area. Some specimens from a single small flock on Maria Cleofa had the line of demarkation between the black and white areas on the breast as sharply defined as in *palliatus*, while others had the mixed black and white areas, as in *frazari* and *galapagensis*. Some of the birds have a white spot on the under eyelid, which is absent in others, but otherwise the color is the same as in typical *palliatus*. Birds from the Tres Marias and the mainland coast to the south have an average shorter bill and tarsus than true *palliatus*, and in this character approximate *frazari* and *galapagensis*. Mr. Ridgway has already called attention to the close general similarity existing between the two latter species. The series from the Tres Marias and adjacent coast agree with specimens in the National Museum from various points along the Pacific coast of Mexico, Central, and South America in being very close to typical *palliatus*, thus showing pretty conclusively that this is the resident bird along the coast and adjacent islands south of Lower California.

So far as can be judged from specimens at hand, *H. galapagensis* is distinct from *frazari*, although the birds resemble one other more closely than they do representatives of *palliatus* from the adjacent mainland. A series of specimens from the southern end of Lower California will probably show intergradation between *palliatus* and *frazari*. The following measurements show the comparative sizes of birds from various localities:

Measurements of Hæmatopus palliatus, H. frazari, and H. galapagensis.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Hæmatopus palliatus	Atlantic coast, United States and West Indies.	♀	3	260	102.3	90	63
Hæmatopus palliatus	Tres Marias and Isabel Islands.	♂	6	256	100.1	75.8	58.1
Hæmatopus palliatus	Tres Marias and adjacent coast.	♀	5	262.2	104	83.8	58.4
Hæmatopus palliatus	Peru and Chile	♀	2	263	97.5	84	61
Hæmatopus frazari	Coast of Lower California	?	4	250.2	116.8	74.4	56.9
Hæmatopus galapagensis.	Galapagos Islands	♂	2	253	98	83.5	54.5
Hæmatopus galapagensis.	Galapagos Islands	?	3	246.6	101.6	82	57

Columba flavirostris madrensis Nelson. Tres Marias Pigeon.

Columba flavirostris Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 274, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 304, 1874.

Columba flavirostris madrensis Nelson, Proc. Biol. Soc. Washington, XII, p. 6, 1898.

These handsome birds were rather common on Maria Madre and Maria Magdalena, ranging to the summits of the islands, and they probably live also on Maria Cleofa. On Maria Madre they were most numerous along the wooded sides of a canyon some distance back from the coast, where they usually perched among the higher branches of the trees or were seen flying about by twos and threes. Early in the morning a few could be found among the smaller trees on the bases of the foothills near the settlement, but later in the day they retired farther inland to the more heavily wooded slopes. On Maria Magdalena they were numerous in some trees near a group of deserted houses and in old clearings a short distance back from the shore. They came to these trees to feed upon the ripening fruit, but were rather shy. When one becomes startled and takes wing it makes a loud flapping noise that alarms its companions, and then all dash swiftly away. They were less confiding than most of the birds on the islands, but were not so shy as their representatives on the mainland. Wild figs and the small fruit of a tree, probably a species of *Psidium*, or wild guava, were favorite articles of food. Their loud cooing note is uttered at short intervals and is one of the characteristic sounds in the forests they frequent. They are essentially arboreal in habits and are rarely seen near the ground.

Zenaidura macroura (Linn). Mourning Dove.

A single mourning dove was taken on May 5, on Maria Madre, and a few others were seen on the island during the first half of the month. They were found for a short time about an old field near the shore, and, like several other species, were probably stray migrants.

Leptotila fulviventris brachyptera (Salvadori). White-fronted Dove.

There is a typical specimen of this bird in the National Museum collection, which was taken on the Tres Marias by Colonel Grayson. It was undoubtedly a straggler from the mainland, as it shows no approach toward the characters distinguishing the resident insular species.

Leptotila capitalis Nelson. Tres Marias Dove.

Leptoptila albifrons Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 274, 1871 (part); Lawr., Mem. Boston Soc. Nat. Hist., II, p. 305, 1874 (part).
Leptotila capitalis Nelson, Proc. Biol. Soc. Washington, XII, p. 6, 1898.

Very common on Maria Madre and Maria Magdalena, and probably occurs also on Maria Cleofa. They run about on the ground under the shade of the forest with motions like those of a quail. During the morning and evening hours quiet trails leading through the forest are their favorite resorts. When walking along these trails one sees them for a moment, sometimes running and sometimes on the wing close to the ground, as they disappear around the next bend. If one is walking slowly the birds will frequently keep ahead for some distance, but if pressed they either run or fly to one side into the sheltering woods. They have a loud cooing note, which is heard at short intervals wherever the birds are common. During the hot hours of the day they retire to the shadiest recesses of the forest and usually perch in some thick-topped tree. While resting in these retreats they have the pretty custom of uttering mellow call notes, as if in response to one another. During the breeding season they are seen in pairs, keeping close together, but at other times are solitary. When forced to take wing, they do so with a loud whirring sound and dart away through the intricate mazes of the dense forest with wonderful quickness. Their agility in flying at full speed among the network of trunks and branches is extraordinary and equalled by few birds. If they take wing without being alarmed, their flight is almost noiseless.

Melopelia leucoptera (Linn). White-winged Dove.

White-winged doves were rather common residents on both Maria Madre and Maria Magdalena, and a few were seen on Maria Cleofa.

Colonel Grayson does not mention having seen this bird during any of his visits to the islands. It seems quite improbable that so conspicuous a species should have been present and overlooked, and I am inclined to believe that it has become a resident of the islands since his visits. It is now a conspicuous and widely spread species and one of the two resident land birds found by us that are not in Grayson's list. In habits and appearance the white-winged doves of the islands are identical with those on the mainland, where the species is very numerous. Two specimens were taken on Maria Madre, May 7, and a single specimen was shot on Isabel Island, April 22; the latter was undoubtedly a straggler from the mainland, since Isabel is a waterless island.

Columbigallina passerina pallescens (Baird). Mexican Ground Dove.

These pretty little doves were common on Maria Madre and Maria Magdalena, but were most numerous about old fields and in the settlement on the former island. The series of specimens taken on Maria Madre appears to be identical with the birds of the adjacent mainland; seven males from the islands average as follows: Wing, 87.4; tail, 61.8; culmen, 11.6; tarsus, 16.6.

Cathartes aura (Linn.). Turkey Vulture.

Generally distributed, and very common about the settlement on Maria Madre.

Buteo borealis fumosus Nelson. Tres Marias Red-tailed Hawk.

Buteo borealis var. *montana* Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 268, 1871 (part).

Buteo borealis var. *calurus* Lawr., Mem. Boston Soc. Nat. Hist., II, p. 301, 1874 (part).

Buteo borealis fumosus Nelson, Proc. Biol. Soc. Washington, XII, p. 7, 1898.

Colonel Grayson records this as a common species. We found a few living along the canyons that score the slopes of Maria Madre. They were very sparsely distributed and only some twelve or fifteen individuals were noted; two or three were seen on Maria Magdalena and none on Maria Cleofa. They were not at all shy, and whenever found perched on a tree were readily approached within gunshot. They feed mainly upon iguanas and rabbits, both of which are common on the two larger islands. Nothing distinctive was noted about the habits of these hawks. They are uniform in color, and differ more from the mainland forms than does *B. borealis socorroensis*, although the latter is from an island much farther out at sea.

The adult female of *fumosus* has some heavy shaft streaks of dark brown on the chest, but these are not heavy enough to form a well-defined dark area as is often the case in *calurus*.

Description of an immature male (?) from Maria Madre: Upper surface almost uniform blackish brown; tail mainly of same color, but crossed by nine narrow, irregular lighter bands; a light area on the throat, where the feathers have narrow blackish shaft lines and broad, dull white borders; breast and sides of neck dull, dark brown, with dull, rusty edgings to feathers on latter area; middle of breast paler; feathers on lower breast and flanks blackish brown, with irregular whitish spots; abdomen and lower tail coverts dull brownish, paler than flanks, with pale buffy barring; some feathers of tibia buffy or heavily barred with buffy, but mostly like those of lower breast.

Below are averages showing the relative size of the two island forms:

Measurements of Buteo borealis fumosus and Buteo b. socorroensis.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Depth of bill.	Tarsus.
Buteo borealis fumosus.	Maria Madre Island.	Ad. ♂	3	373.3	207.3	26	18.5	81.3
Buteo borealis fumosus.	.... do	Ad ♀	1	412	214	30	20	84
Buteo borealis socorroensis.	Socorro Island......	Ad. ♂	2	387.5	207.5	25	17.5	80
Buteo borealis socorroensis.	.....do	Ad. ♀	1	425	221	30	20	86

Falco peregrinus anatum (Bonap.). Duck Hawk.

Falco peregrinus var. *nigriceps* Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 268, 1871.

A single duck hawk was taken by Colonel Grayson, who mentions that it was shot while in close pursuit of a sparrow hawk. We did not see this species during our visit to the islands.

Falco sparverius Linn. Sparrow Hawk.

The sparrow hawk was recorded from the islands by Colonel Grayson, but we did not see a single individual, and it probably occurs merely as a straggler.

Falco columbarius Linn. Pigeon Hawk.

Colonel Grayson records this species as very common upon the islands. Not a single individual was seen by us, and it probably occurs only as a winter visitant or stray migrant.

Falco albigularis Daudin. White-throated Falcon.

Hypotriorchis rufigularis Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 269. 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 301, 1874.

Colonel Grayson took a specimen of this fine little falcon on the islands. None were seen by us, and it must, no doubt, be classed as one of the numerous accidental visitants from the mainland.

Polyborus cheriway pallidus Nelson. Tres Marias Caracara.

Polyborus audubonii Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 268, 1871, (part).

Polyborus tharus var. *auduboni* Lawr., Mem. Boston Soc. Nat. Hist., II, p. 303, 1874, (part).

Polyborus cheriway pallidus Nelson, Proc. Biol. Soc. Washington, XII, p. 8, 1898.

Very abundant about the settlement on Maria Madre and rather commonly distributed elsewhere over the island. They were also rather common on the other islands, including San Juanito. The old log roads and dry bottoms of the canyons on Maria Madre were favorite resorts. The birds were met in many unexpected places, and were frequently seen perched in tree tops in the midst of the unbroken forest. Iguanas were excessively numerous, and furnished the main supply of food for the caracaras; the birds were on the alert, however, for anything in the form of carrion that turned up along shore or in the forest.

Pandion haliaëtus carolinensis (Gmel.) American Osprey.

Several ospreys were seen along the shores of all the islands, where they probably nest. Colonel Grayson found a nest on a rock adjacent to the northern shore of Maria Madre and another in a large cactus. Mr. Forrer obtained an immature bird during his visit to this island.

Strix pratincola Bonap. American Barn Owl.

Colonel Grayson states that he heard the well-known hissing scream of this bird at night on the Tres Marias. We were told of the presence of barn owls on the islands, but did not see them, and failed to learn whether they occur as residents or stray migrants.

Speotyto cunicularia hypogæa (Bonap.) Burrowing Owl.

Colonel Grayson says of the burrowing owl, "A few individuals of this species inhabit the Marias Islands, perhaps wandered from the mainland." We neither saw nor could learn anything of them, and those seen by Colonel Grayson were probably winter stragglers.

? Micropallas Sp.

The first evening after landing on Maria Madre, Mr. Goldman saw and heard a little owl about the size of *Glaucidium phalænoides* on an old log road in the forest. It was very near, and when he had moved back far enough to shoot without destroying the bird it became too indistinct to see and so escaped. Its notes were not like those of the ferruginous owl. This was the only one seen or heard during our stay. If a resident, it is very uncommon, for special but unsuccessful efforts were made to find others.[1]

Amazona oratrix Ridgway. Double Yellow-headed Parrot.

Chrysotis levaillantii Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 271, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 296, 1874.

Amazona oratrix Ridgway, Man. N. Am. Birds, p. 594, 1887.

The yellow-headed parrot is a common resident and always nests in holes high up in large trees in the forest. Half-grown young were found the middle of May. The birds were usually seen flying about the forest in pairs, but congregated in flocks of from six to twenty or more at their feeding places. They feed upon the fruits of various trees, and during May the fleshy pods of *Pithecolobium dulce* formed their staple article of diet. These low trees, from 15 to 35 feet high, were growing around the houses of the settlement on Maria Madre and were scattered thence along the coast, especially about the borders of old clearings and in scrubby second growth on the lower slopes. A number of yellow-headed parrots came down every day to feed in the trees, even among the houses, and did not pay the slightest attention to passing people. As these birds readily learn to talk, they are highly prized as pets, and are sold to visitors, or sent to towns on the mainland; the birds taken while young being most highly prized on account of their docility. The men search for their nests, and when one is located the hunter strikes the base of the tree several sharp blows with a stone or ax, and then places his ear against the trunk and listens. He can tell whether the young are old enough to remove, by the strength of the cries they utter in reponse to the blows on the tree. Being satisfied of the presence of his game, the hunter climbs the tree, and if necessary cuts into the nest with his machete. Each brood contains two young, which are carried to the ground inside the hunter's shirt. By means of a noose on the end of a long cane, like a fishing rod, many old parrots are captured while feeding. An old woman had twenty birds which she had taken in this manner while they were feeding in the top of a small *Pithecolobium* tree by her door. The hunters search for regular feeding places in the forest and wait under the trees for the birds to come. When the birds arrive, the end of the rod is slowly and cautiously pushed up through the branches, the noose slipped over the bird's head and drawn about its neck with a quick jerk, after which the victim is hauled down and thrust into a cage. A favorite resort for the parrots on Maria Madre was a group of trees about half a mile from the settlement. The birds were very unsuspicious, and one could walk up within 20 or 25 yards in full view and watch them without their paying much attention. The parrots were constantly chattering, and the greatest good comradeship seemed to prevail. Mates kept close together and showed their attachment by caressing and feeding one another at short intervals. The proficiency in speaking which some of these birds attain is remarkable. The daughter of the customs inspector on Maria Madre had one which afforded much amusement by the variety of its remarks and their frequently absurd appropriateness. Colonel Grayson supposed these birds to be peculiar to the Tres Marias, as he did not chance to find them on the mainland. In reality, they are widely distributed on both coasts of Mexico.

---

[1] During the visit to Maria Magdalena Island a larger owl was seen in the forest along the bottom of a steep canyon, but was not sufficiently near to identify, and escaped before it could be obtained. This was probably *Ciccaba squamulata* (Bonap.), a species which is not rare on the mainland.

After comparing the series taken on the islands with specimens from both coasts of the Mexican mainland certain slight differences are noticeable, but are too poorly defined to be worthy of subspecific recognition. The island birds are usually apple green on the dorsal surface, and mainland specimens are more of an oil green; the ventral surface has a more decided bluish wash; there is also tendency to a richer suffusion of orange and orange red on the yellow feathers about the necks of old birds.

The following measurements show that the island birds are a little larger than those of the mainland, with proportionately smaller bill and shorter tarsus. Averages of 9 specimens from the islands (both sexes): Wing, 233.3; tail, 133.6; culmen, 34.3; tarsus, 24.7. Averages of 7 specimens from both coasts of the mainland (both sexes): Wing, 222.5; tail, 120.1; culmen, 34.4; tarsus, 24.5.

Some old residents on Maria Madre reported that they had occasionally seen stray individuals of another parrot which was a little smaller than the yellow head, probably *Amazona finschi*, which is abundant on the mainland.

Psittacula insularis Ridgway. Tres Marias Lovebird.

Psittacula cyanopyga Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 271, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 297, 1874 (part).

Psittacula insularis Ridgway, Proc. U. S. Nat. Museum, X, 1887, p. 541 (Aug. 1888).

Psittacula cyanopygia Salvadori, Cat. Birds Brit. Mus., XX, p. 249, 1891 (part).

Lovebirds, or 'catarinas,' as they are called by the Mexicans, are common on Maria Madre and Maria Magdalena, and probably occur on Maria Cleofa, although none were seen on the latter island. They were usually seen in flocks, from a few pairs up to 30 or 40 individuals, and in May were feeding on small, sweet, wild figs, common on the lower slopes. While feeding they keep up a constant chattering, which notifies one of their presence. When flying over the top of the forest they keep in compact flocks and move steadily forward with rapid wing beats, suggesting a flock of cedar birds. They are very gentle, affectionate little creatures and quickly become tame and greatly attached to their owners.

Salvadori considers *Psittacula insularis* a synonym of *P. cyanopyga*. The series of eight adults from the islands and seven from the mainland show that the island birds can be readily distinguished. The two series show no signs of intergradation in color, and their specific distinctness is well defined, although the average measurements show but slight differences in size.

Description of Psittacula insularis, ♂ ad., Maria Madre, May, 1897:	*Description of Psittacula cyanopyga, ♂ ad., Tepic, Mexico, April, 1897:*
Cheeks, lores, forehead, and crown, back to line between orbits, rich green, decidedly clearer than in *cyanopyga*, and much more sharply contrasted with surrounding colors.	Cheeks, lores, and forehead bright green, more yellowish than in *insularis*, and shading gradually into surrounding colors.
Middle of crown green, shading abruptly into dull bluish green, which extends thence over neck, middle of back, scapulars, tertials, and lesser wing coverts.	Crown, from between orbits, neck, middle of back, scapulars, tertials, and lesser wing coverts, dark green without bluish.
Rump patch, axillars, and greater wing coverts vivid cobalt blue.	Rump patch, axillars, and greater wing coverts bright turquoise blue.
Upper tail coverts brighter green than middle of back, but darker than in *cyanopyga*.	Upper tail coverts clearer green than back.
Upper surface of tail dark green, darker than in *cyanopyga*.	Upper surface of tail rich green.

Secondaries and outer vanes of primaries near base, dark blue; primaries with outer vanes along distal half and at tips edged with dark green; inner webs of primaries brown.	Secondaries and outer vanes of inner primaries dark blue; rest of outer vanes and tips of primaries dark green; inner webs of primaries brown.
Exposed under surface of primaries and secondaries dull blue.	Exposed under surface of primaries and secondaries dull bluish green.
Lower parts, back to crissum, dingy blue with a dull greenish wash; blue brightest on abdomen, and contrasting abruptly with green of crissum.	Lower parts, back to crissum, dull green, richest on abdomen and shading insensibly into color of crissum.
Crissum rich dark green.	Crissum brighter green.

Description of Psittacula insularis, ♀ ad., Maria Madre, May, 1897.	*Description of Psittacula cyanopyga, ♀ ad., from Tepic, Mexico, April, 1897.*
Entire dorsal surface dingy green; brightest on sides of head, forehead, rump, and upper tail coverts, with a dull bluish shade on middle of back and wings.	Dorsal surface dark green; brightest on forehead, rump, and upper tail coverts, with an olive shade on middle of back and wings.
Lower surface dull green, back to crissum; the latter brighter green.	Lower surface nearly uniform light green, with a yellowish shade; crissum nearly the same.

Average measurements of Psittacula insularis and P. cyanopyga.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Psittacula insularis	Maria Madre Island	ad. ♂	6	91.8	45.8	13.9	12.9
Psittacula insularis	do	ad. ♀	2	91.5	46.5	13.5	13
Psittacula cyanopyga	Tepic and Jalisco	ad. ♂	3	90.6	45.6	12.8	13.1
Psittacula cyanopyga	do	ad. ♀	4	89.2	41.5	13.1	12.7

Coccyzus minor (Gmel.) Mangrove Cuckoo.

This bird is rather common among the mangroves and other trees bordering the salt lagoons near San Blas. A single specimen was taken on May 8 near the shore of Maria Madre, but no others were seen, and it probably occurs there only as a straggler.

Trogon ambiguus goldmani Nelson. Goldman's Trogon.

Trogon ambiguus Grayson Proc. Boston Soc. Nat. Hist., XIV, p. 272, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 290, 1874 (part).

Trogon ambiguus goldmani Nelson, Proc. Biol. Soc. Washington, XII, p. 8, 1898.

Goldman's trogon was common in the more heavily wooded parts of Maria Madre and Maria Magdalena, and occurs no doubt on the less heavily wooded Cleofa. On Maria Madre they were found from the coast up nearly to the summit in suitable timber and especially along the sides and bottoms of heavily wooded canyons. Their habits were similar to those of the mainland bird. They sit quietly for a time on a branch and then fly, with an undulating motion, to another tree in the vicinity. Their notes are limited to a short succession of unmusical sounds, which are frequently heard. They were reported to nest in hollow trees. Unlike most of the birds of these islands, the trogons were nearly as shy as their representatives on the mainland In life they have light yellow bills and bright red eyelids.

Ceryle alcyon (Linn.). Belted Kingfisher.

Colonel Grayson records that during each of his visits one or two belted kingfishers were observed sitting on rocks along the seashore. None were seen by us.

Dryobates scalaris graysoni (Baird). Grayson's Woodpecker.

Picus scalaris var. *graysoni* Baird, Hist. N. Am. Birds, II, pp. 515, 517, 1874; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 294, 1874.

This is the only woodpecker found on the Tres Marias. It is common on all of the islands and generally distributed, except in the most heavily wooded areas. It seems to prefer second-growth thickets and other places where shrubs and scrubby trees form low and rather thin forests, and was usually seen hunting for food along the trunks of large shrubs or small trees. It was a common practice for them to alight on tree trunks near the ground and work slowly to the top, and after remaining there quietly for a time to make a short flight to another tree. Like its relative of the mainland, it is a very quiet bird, rarely uttering any call notes and making little noise while searching for food. From its habit of peering into crevices of the bark and doing only a small amount of pecking it is evident that it finds most of its food on or near the surface. Old nesting sites were seen in the trunks of both living and dead trees and in the flower stems of large magueys. The holes were usually between 5 and 10 feet from the ground. Colonel Grayson found a nest about 12 feet from the ground in the green flower stem of a large maguey (*Agave*) near the seashore in April.

A comparison of a series of these island woodpeckers with other forms shows that the dorsal surface, including the crest of the males, is most like typical *D. scalaris* from the plains of Puebla. On the ventral surface it may be distinguished from all the other races by its whiter color and scantier and smaller black markings along the sides. These markings are usually in the form of small rounded spots instead of more or less elongated streaks, as in the other races, and the white markings on the greater and lesser wing coverts are decidedly larger and more conspicuous. *D. s. graysoni* averages a little smaller than *D. s. scalaris*. The darker dorsal surface and unmarked bases of outer tail feathers distinguish it from *D. s. bairdii*. It has a shorter, stouter bill than *D. s. lucasanus*, with considerably more barring on the outer tail feathers. From *D. s. sinaloensis* it is distinguished mainly by its larger size, darker dorsal surface, and paler, less marked lower surface. The following averages show the relative size of *graysoni* and *sinaloensis:*

Measurements of Dryobates s. graysoni and Dryobates s. sinaloensis.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Dryobates scalaris graysoni.	Maria Madre Island	ad. ♂	6	98.7	59.6	22.1	18.6
Dryobates scalaris graysoni.	do	ad. ♀	3	96.6	57	19.5	17.5
Dryobates scalaris sinaloensis.	Sinaloa and Tepic	ad. ♂	3	94.6	53.6	19.8	17.1

An adult female in the National Museum collection from Mazatlan, while having the normal bill and tarsus of *sinaloensis*, agrees with birds from the Tres Marias in its long wings and tail. Its measurements are as follows: Wing, 96; tail, 60; culmen, 18.5; tarsus, 16.5.

Nyctidromus albicollis insularis Nelson. Tres Marias Parauque.

Nyctidromus albicollis Grayson, Proc. Boston Soc. Nat. Hist. XIV, p. 273, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 291, 1874.

Nyctidromus albicollis insularis Nelson, Proc. Biol. Soc. Washington XII, p. 9, 1898.

On the mainland the parauques are rarely seen while the sun is above the horizon, but when night falls they come out of the dense thickets where they have passed the day and sit in dusty trails and other open places. On Maria Madre they were among the commonest birds frequenting old log roads through the forest and shady canyon bottoms until late in the morning and coming out again at 3 or 4 o'clock in the afternoon. Of late years these places have been so completely given over to solitude that when a human being chances to stray into them he is looked upon with little fear. The wood folk seem to consider him harmless and only a strange creature of their own kind.

Parauques were among the most confiding birds found in these quiet retreats and permitted a close approach before taking wing and moving away. In the early dusk they were frequently seen hawking for insects among the low trees. Several came about camp at the north end of Maria Madre just after sunset, and flew very swiftly back and forth with the same erratic course and vigorous wing strokes that are so characteristic of the night-hawk. In fact, I mistook one of these birds for a night-hawk until it was secured. Their notes remind one slightly of the whip-poor-will's, but are not so loud and far-reaching. The regular call is made up of two and sometimes three syllables, besides which they have various little clucking and purring notes.

Curiously enough the parauques of the Tres Marias bear a much greater resemblance, in size and color, to *N. albicollis merrilli* of the Rio Grande Valley than to the ordinary birds of the adjacent mainland.

Chordeiles acutipennis texensis (Lawr.) Texas Nighthawk.

A single specimen was taken May 5 on Maria Madre, and several others were seen during the first half of the month, after which time they disappeared. These birds were probably stray migrants, for there was nothing to indicate that they were residents.

Amazilia graysoni Lawr. Grayson's Humming Bird.

Amazilia graysoni Lawr., Ann. Lyc. Nat. Hist., N. Y., VIII, p. 404, 1867.

Pyrrhophœna graysoni Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 283, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 292, 1874.

Very common on the islands. They were seen almost everywhere darting about the less luxuriant parts of the forest hunting for flowers, and now and then stopping on a twig in some low tree top to rest or arrange their plumage. They were among the numerous feathered visitors to the little flower garden at the custom-house on Maria Madre where they were very confiding, and would carry on their search for food among the flowers quite indifferent to one's presence. These humming birds are very pugnacious, as the following incident recorded by Colonel Grayson well illustrates: "Sometimes combats between them become of a desperate nature. One day while watching a number of them in active motion around some tobacco flowers (of which they seem to be very fond) two fine males, after darting at each other for some time, at length came to a deathly struggle, high above my head; they finally clinched each other, each having one of the mandibles of the other in his mouth, at the same time scratching with their little claws, and using their wings with the greatest force, and in this situation, whirling round and round, they fell to the ground near my feet. During this terrible conflict, in which passion and desperation were exhibited, I observed them for a few seconds and then gently placed my hat over both. Even after they were thus captured, and I held one in each hand, they evidenced a desire to continue the war."

The same author records having seen these hummers dart upon and capture little flies in the manner of a flycatcher, and found their crops full of minute insects. This I can corroborate from my own observations.

Upon comparing a series of 8 specimens of *Amazilia graysoni* with an equal number of *A. cinnamomea* the general style of coloration is seen to be very similiar, yet the differences between the two forms are so constant it seems advisable to consider them specifically distinct. The dorsal surface of *A. graysoni* is a more dingy green with less coppery iridescence than in *cinnamomea;* the bronze tips of the tail feathers are less uniform, and the extreme points sometimes terminate with a little cinnamon spot; the cinnamon of the lower surface is considerably darker. There is also a well marked and constant difference in size—*graysoni* being the larger, as shown by the following averages:

Measurements of Amazilia graysoni and A. cinnamomea.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.
Amazilia graysoni	Maria Madre Island	ad. ♂	4	68.8	42.6	25
Amazilia graysoni	do	ad. ♀	4	65.9	43.4	25.4
Amazilia cinnamomea	Western Mexico	ad. ♂	7	57.9	36.6	22
Amazilia cinnamomea	do	ad. ♀	1	53	32.5	23

Iache lawrencei Ridgway. Lawrence's Humming Bird.

Circe latirostris Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 282, 1871.
Iache lawrencei (Berlepsch, Ms.) Ridgway, Man. N. Am. Birds, p. 320, 1887.

Like the preceding species this is a common and generally distributed bird, and was found on all the islands. Like Grayson's humming birds, they were common about the flower garden at the custom house on Maria Madre. Colonel Grayson found its nest on Maria Madre and describes it as follows: "The elegant little structure I found attached to a slender twig, and shaded with its leaves, about 5 feet from the ground. The situation was fronting the sea, but a few paces from the water's edge, where the first beams of the morning sun dissolved the dews. Its form is cup-shaped, and composed of the down of the silk cotton tree (*Eriodendron*) intermingled with the down of other plants and spider webs, the whole exterior neatly studded with diminutive lichens; it contained two newly hatched young, but little larger than flies."

In general appearance *Iache lawrencei* closely resembles *I. latirostris.*[1] The dorsal surfaces of the males are nearly the same color, but the upper tail coverts of *lawrencei* are grayish instead of green, as in *latirostris;* their lower surface is a darker, duller green; the blue-throat patch is nearly obsolete and replaced by an extension of the green of the neck; the under-tail coverts are darker brown.

The females of *lawrencei* differ mainly from those of *latirostris* in the clearer, brighter green of the dorsal surface and darker under-tail coverts. As the differences between the two birds seem to be fairly constant, although not very striking, it is perhaps advisable to treat them as species until more material proves the contrary.

The type of *I. latirostris* formed part of the Bullock collection and probably came from the southern end of the table-land near the Valley of Mexico. The following measurements show the differences in size:

---

[1] *Iache latirostris* undoubtedly occurs on the islands as a straggler. About midway on our return to the coast a hummer passed close to the side of the boat, coming from the direction of San Blas and heading in a direct line for the islands. As this wanderer passed I had a close view and identified it as *I. latirostris.*

Measurements of Iache lawrencei and I. latirostris.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.
Iache lawrencei	Maria Madre Island	ad. ♂	3	52.3	32.6	18.8
Iache lawrencei	do	ad. ♀	4	51.2	29.2	20.2
Iache latirostris	Southern table-lands, Mexico	ad. ♂	5	54.2	33	21.9
Iache latirostris	do	ad. ♀	1	52	33	23

Platypsaris aglaiæ insularis (Ridg.) Grayson's Becard.

Hadrostomus aglaiæ var. *affinis* Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 279. 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 289, 1874.

Platypsaris insularis Ridgway, Man. N. Am. Birds, p. 325, 1887.

The rose-throated becard was not common and only three specimens were taken, all on Maria Madre. They were found in the heavier forest on the slopes well back from the coast, and nothing unusual was noted in regard to their habits. They probably occur on Maria Magdalena and perhaps on Maria Cleofa. A considerable series of specimens from various parts of Mexico shows that a single species of rose-breasted becard ranges over a large part of Mexico and has developed four geographical subspecies. The ranges of these four forms may be defined as follows:

Platypsaris aglaiæ (Lafr.). Eastern Mexico from northern Tamaulipas south along basal slopes of the Cordillera of Vera Cruz and Tabasco to arid parts of Yucatan. (Type from vicinity of Jalapa, Vera Cruz.)

Platypsaris aglaiæ sumichrasti Nelson. Humid lowlands of Vera Cruz, and thence southward in similar country nearly or quite to Guatemala. (Type from Otatitlan, Vera Cruz.)

Platypsaris aglaiæ albiventris (Lawr.). West coast of Mexico from the Isthmus of Tehauntepec to southern Arizona, ranging along river valleys into the interior of western Mexico. (Type from Plains of Colima)

Platypsaris aglaiæ insularis (Ridg.). Tres Marias Islands. (Type from Maria Madre Island.)

Typical specimens of *insularis* are much darker than typical examples of *albiventris*. Specimens from the coast lowlands about San Blas are intermediate in color. The island birds, however, may usually be distinguished by their smaller bills. Back from the coast of Tepic, especially in the arid river canyons at Bolaños and near Guadalajara, only typical specimens of *albiventris* were found. On the eastern side of Mexico these two forms are paralleled by the pale bird of the foot hills and adjacent interior (*aglaiæ*) and the darker one of the coast lowlands (*sumichrasti*). The color of extreme specimens of *albiventris* is very different from that of *aglaiæ* and *insularis*, but among the series from western Mexico, where *albiventris* has its home, are various intermediate stages, some specimens approaching very closely to both the forms just named. Some specimens of *insularis* are much nearer typical *aglaiæ* in color than *albiventris*. Females of *insularis* are more distinct from those of *aglaiæ* than the males, owing to their generally grayer backs, but even this is not a constant character. The only character of *insularis* that is fairly constant is the smaller bill; a curious development, since there is a general tendency to an increase in size of bill among Tres Marias birds.

Measurements of Platypsaris aglaiæ and its races in Mexico.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Platypsaris aglaiæ	Eastern Mexico	ad. ♂	3	94.3	72.3	16	21.8
Platypsaris aglaiæ sumichrasti.	Otatitlan, Vera Cruz	ad. ♂	3	89.6	68.3	16.3	22
Platypsaris aglaiæ albiventris.	Plains of Colima and Bolaños, Jalisco.	ad. ♂	4	90.5	67.5	15.8	21.6
Platypsaris aglaiæ insularis.	Maria Madre Island	ad. ♂	3	87	66.8	14.3	22.1
Platypsaris aglaiæ insularis.	do	ad. ♀	3	88	66.6	15	22.3
Intermediates between P. a. albiventris and P. a. insularis.	Coast near San Blas, Tepic	ad. ♂	3	89.8	64.3	15.3	22.3

Tyrannus melancholicus couchi (Baird.) Couch's Kingbird.

On Maria Madre Island ten or a dozen of these birds were seen and appeared to be resident. Two or three were noted on Maria Magdalena, and others on Maria Cleofa, where they were most numerous. They were always found near the seashore. The specimens obtained seem to be identical with those from the adjacent mainland. As a rule birds from northeastern Mexico, the type locality, are lighter than those from western Mexico, but this difference is not constant.

Myiarchus mexicanus magister Ridgway. Arizona Crested Flycatcher.

Although resident on all the islands, birds from the Tres Marias are almost identical with those from the mainland, and nothing distinctive was noted in their habits. They frequent the thinner parts of the scrubby forests which cover most of the slopes, but were most numerous within a mile or two of the sea. They kept among the low trees, usually perching on tops of bushes or on branches within 10 or 15 feet of the ground, where they watched for passing insects.

Myiarchus lawrencei olivascens Ridgway. Olivaceous Flycatcher.

This was much more abundant than the preceding species, and one of the commonest and most generally distributed resident birds on the islands. Like the preceding, it was most numerous in the scrubby forest within a mile or two of the seashore and kept among the branches of trees and bushes within 10 or 15 feet of the ground. Its habits were the same as on the mainland.

A careful comparison of series from the islands and the mainland shows but little difference. The island birds are slightly grayer on the back, the bills average a little longer and wider, and the tarsus is longer, but these differences are too slight to warrant subspecific recognition. Unfortunately the type of this subspecies is based on a winter specimen from Santa Efigenia, Oaxaca, near the border of Chiapas. This leaves the summer range of typical birds in doubt.

Below are averages of specimens from the islands and the mainland:

Measurements of Myiarchus lawrencei olivascens.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Myiarchus lawrencei olivascens.	Tres Marias Islands	ad. ♀	7	76.3	74.8	16.8	19.7
Myiarchus lawrencei olivascens.	Northwest Mexico, southern Arizona.	ad. ♀	7	76.8	74.7	16.1	18.8

Contopus richardsonii (Swains). Western Wood Pewee.

During the first ten days of May these birds were not uncommon in some of the denser growths of small trees along the lower slopes of Maria Madre. None were seen on the other islands and they all disappeared a little later, showing that they were merely stray migrants. The single specimen taken is identical with others from the western United States.

Empidonax difficilis Baird. Western Flycatcher.

These birds were very sparingly distributed on the Tres Marias. They were seen on Maria Madre soon after our arrival, and on May 27 one was taken on Maria Magdalena. They were usually found in dense thickets and along shady canyons. Colonel Grayson records them as common, but they undoubtedly occur only as winter visitants and migrants.

Ornithion imberbe (Sclater). Beardless Flycatcher.

Two specimens were taken and a few others seen early in May on Maria Madre; none were seen later, and they probably occur merely as stragglers during migration. They move about like small vireos in the tops of low trees and in large bushes, searching the outer twigs for insects and flying out every now and then to capture one on the wing.

A series of specimens from various localities on both coasts and the interior of Mexico, the Tres Marias Islands, and southern Arizona fails to show any tangible characters to distinguish *O. imberbe ridgwayi* from typical *O. imberbe*.

Myiopagis placens (Sclater). Golden Crowned Flycatcher.

In the National Museum collection is a typical specimen of *M. placens*, taken by Colonel Grayson in January, 1865, on the Tres Marias Islands, which agrees perfectly in size and color with the large dark birds from the mountains of Jalisco, on the adjacent mainland. Eight specimens of both sexes from various localities in Mexico and Central America average as follows: Wing, 68.2; tail, 65.8; culmen, 11.2; tarsus, 19.1.

Myiopagis placens minimus Nelson. Little Golden Crowned Flycatcher.

Elainea placens Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 279, 1871; Mem. Boston Soc. Nat. Hist., II, p. 286, 1874.

Myiopagis placens minimus Nelson, Proc. Biol. Soc. Washington, XII, p. 9, 1898.

Early in May a few of these birds were seen in the low scrubby forest near the shore on Maria Madre, but by the middle of the month they had retired to the heavily wooded canyons and slopes above 600 or 800 feet. They were common among the trees bordering the head of a large canyon in the middle of the island, where a small spring formed the center of attraction for many birds. Like their mainland relative, they frequent the tree tops, where they may be seen running in and out among the ends of the branches and fluttering about the tips of twigs in the manner of some warblers. They frequently hop from twig to twig, with their tails uptilted like gnatcatchers, but their dull garb is usually sufficient to identify them. When high up in the tops of tall trees, however, their form and habits are so warbler-like that they can not be distinguished from other small birds. A few individuals were seen on Maria Magdalena, but none on Maria Cleofa.

Corvus mexicanus Gmelin. Mexican Crow.

Two residents on Maria Madre reported that at long intervals they had seen stray crows on the island. My informants were familiar with the bird on the mainland, where it is extremely numerous about San Blas, and there is no reason to doubt the correctness of their identification.

Cissolopha beecheyi (Vigors). Beechey's Jay.

A specimen of this bird in the National Museum collection, obtained by Xantus, is labeled "Tres Marias Islands, October 15, 1859". This record, however, is doubtful.

Icterus graysoni Cassin. Grayson's Oriole.

Icterus graysoni Cassin, Proc. Acad. Nat. Sci. Phila., p. 48, 1867; Mem. Boston Soc. Nat. Hist., II, p. 280, 1874.

These beautiful birds are very common on all of the islands. Although more numerous about the settlement on Maria Madre than elsewhere, they were common in the thin, low forest all about the lower parts of the islands and were very unsuspicious. During my excursions through the woods they came again and again and alighted on low branches of shrubs or trees beside the old log roads and peered at me with innocently inquiring eyes as if wondering at the strange creature newly arrived in their haunts, but evidently quite unconscious of any feeling that the newcomer might be dangerous. Such confidence made it very trying work to collect many of these birds.

They came familiarly about the houses and yards at the settlement on Maria Madre. A number of them made several visits each day to the verandas and shrubbery about the custom-house, and added greatly to the attractive surroundings by their bright colors and frank unconcern. They searched for insects among the shrubs and small trees in the patio or court, came to the veranda railing, down upon the floor, and along the walls, where plump spiders furnished many choice morsels. Several bags of corn piled against the wall on one side of the veranda were infested with weevils, which could be found creeping about on the outside of the bags. A pair of orioles was in the habit of regularly visiting the veranda and soon discovered these insects. They walked all over the bags, sometimes upside down or on one side like a nuthatch, and pried into every spot likely to contain a little beetle. They were frequently seen also clinging to the stems of the giant cactus (*Cereus*) and feeding on the juicy fruit.

As Colonel Grayson has recorded, the nests of these orioles are about a foot in length and of the usual purse shape. They are made of fibers of grass or maguey plants, lined with silk cotton and swung near the end of some slender branch overhanging a clear space, usually from 18 to 35 feet above the ground.

Grayson's oriole is evidently an offshoot from the wide-ranging *Icterus pustulatus* of the adjacent coast, but has become sufficiently distinct to rank as a species. Like so many of the island birds, it is larger than its mainland relative. The yellow is much lighter than on *I. pustulatus* and lacks most of the intense orange that is so conspicuous on many of the latter birds. Some adult males of *graysoni* have the back entirely bright yellow, while the backs of others are marked with a few narrow black shaft streaks. The females of *graysoni* are more greenish-yellow and have but faint traces of the orange shade present in typical *pustulatus*.

The following averages show the relative dimensions of the two species:

Measurements of Icterus graysoni and I. pustulatus.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Icterus graysoni	Maria Madre Island	ad. ♂	4	104	89.7	25.4	26.7
Icterus graysoni	do	ad. ♀	4	96.7	84.2	25.1	26.2
Icterus pustulatus	Western Mexico	ad. ♂	4	100.2	91	21	25.6
Icterus pustulatus	do	ad. ♀	4	91.7	81.5	20.2	24.5

Quiscalus macrourus Swainson. Great-tailed Grackle.

Two of these grackles were shot the latter part of May on a level bit of ground bordering the shore in front of the settlement on Maria Madre. They were the only ones seen and were undoubtedly stragglers from the mainland where they are abundant and resident near San Blas.

Astragalinus psaltria mexicanus (Swainson). Mexican Goldfinch.

Rather common and apparently resident, but nothing distinctive was observed in their habits. On Maria Madre they were usually found on the lower slopes and were most numerous about the settlement. Ten specimens fail to show any characters distinguishing the island birds from those of the mainland.

Cardinalis cardinalis mariæ Nelson. Tres Marias Cardinal.

Cardinalis virginianus Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 281, 1871.

Cardinalis virginianus var. *igneus* Lawr., Mem. Boston Soc. Nat. Hist., II, p. 275, 1874.

Cardinalis cardinalis mariæ Nelson, Proc. Biol. Soc. Washington, XII, p. 10, 1898.

Cardinals were very common on Maria Madre and not uncommon on the rest of the group. No one ever molests them, and they were especially abundant about the settlement, where they came into the yards and around the houses in the most familiar way. Several pairs could be found at any time during a short walk in the scrubby thickets along the lower slopes of the island. While we were hunting in the low woods it was a common occurrence for them to come very near, and after looking at the intruders with mild curiosity for a short time, to move off through the bushes in quiet pursuit of their usual occupations. At other times, while engaged in search of food among the fallen leaves they would scarcely notice one as he walked slowly by within three or four paces.

Piranga ludoviciana (Wilson). Louisiana Tanager.

During the first half of May these tanagers were not uncommon near the settlement on Maria Madre, but were not seen on the other islands. Those shot the first of the month were in fair condition, and, several pairs being seen, it was at first considered a resident species. Later, when others were secured, it was noted that they were more and more emaciated, until those killed about the middle of the month were so excessively thin, it was surprising that they had continued to live. About this time the last ones disappeared, no doubt dying from starvation. From these observations it appeared that the birds must have strayed to the island during migration, about the last of April or first of May, and were unable to find a proper food supply. At the same time they feared to start over the sea for an invisible shore and so perished. Another member of the genus, *Piranga bidentata flammea*, is resident in large numbers on the islands and found an abundant food supply, as was shown by their being among the fattest birds collected during the time that *P. ludoviciana* was dying of starvation.

Piranga bidentata flammea (Ridgway). Tres Marias Tanager.

Pyranga bidentata Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 281, 1871; Mem. Boston Soc. Nat. Hist., II, p. 274 (part), 1874.

Piranga flammea Ridgway, Man. N. Am. Birds, p. 457, 1887.

Several species of birds were very much at home about the settlement on Maria Madre, and among these the brilliant Tres Marias tanager was one of the most numerous. Like Grayson's oriole, they came daily to the veranda railing and investigated the shrubs and small trees in the court and flower garden at the custom-house. These birds were common and generally distributed in the scrubby forest on the lower parts of Maria Madre and Maria Magdalena, and probably occur on Maria Cleofa, although none were seen there. Their habits were very much like those of *Piranga bidentata* on the mainland. On the island, however, these tanagers were most numerous within a few hundred feet of sea level, while their relatives of the mainland inhabited oak forests at an altitude of 2,000 or 3,000 feet. They have a short warbling song, which is similar to, but less musical than, that of the mainland bird. They were seen hunting for food in the small tree tops of the scantier forest growths rather than in the more densely wooded areas and were very fat.

P. bidentata was described by Swainson from a specimen in the Bullock collection, taken at Temascaltepec, southwest of the Valley of Mexico, on the Pacific slope of the mountains. It was described as having the 'head, neck, and under parts golden'. This style of coloration is shown in specimens from various localities in Jalisco, Sinaloa, and the Tres Marias Islands. Judging from specimens in the National Museum and from the results of recent work, tanagers of this description are only found north of the Isthmus of Tehuantepec, on the arid western slope of Mexico, and are not common. The Tres Marias tanager is closely related to typical *P. bidentata*, and the males are so closely alike in color that it requires careful scrutiny to find distinguishing characters. In *P. flammea* the white tips of the greater and lesser wing coverts are larger and clearer white than in *P. bidentata*, thus rendering the two wing bands more conspicuous. The white spots on the outer rectrices are smaller and confined to the inner webs, except at the extreme tip; in *P. bidentata* these marks occupy most of the terminal third of the feathers. In general color of the body the two forms are indistinguishable. The bill of *P. flammea* averages longer and is decidedly more swollen, especially toward the tip; this difference is one of the most important characters of the island form. The female of *P. flammea* can be distinguished only by the larger bill and the restriction of the white spot on the outer pair of tail feathers.

The following measurements give the averages of the two forms:

Measurements of Piranga bidentata and Piranga b. flammea.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Piranga bidentata flammea.	Maria Madre Island..	ad. ♂	6	98	81	18.1	23.7
Piranga bidentata flammea.	.....do	ad. ♀	4	95	78.7	18.4	22.5
Piranga bidentata	Jalisco and Sinaloa...	ad. ♂	3	98	79.3	17.3	21.1
Piranga bidentata	.....do	ad. ♀	2	96	79	17	21.5

Hirundo erythrogaster Bodd. Barn Swallow.

Soon after our arrival on Maria Madre a few swallows, supposed to be this species, were seen by my assistant, but none were taken. They were undoubtedly stray migrants, for none were seen afterwards.

Vireo flavoviridis forreri (Madarasz). Forrer's Vireo.

Vireo forreri Madarász, Természetrajzi Füzetek, IX, pt. I, p. 85, 1885.

Although Forrer's vireo is one of the most abundant and widely distributed species on the islands, yet it does not appear in Grayson's list. It was very common in the small trees in the patio of the custom-house and elsewhere about the settlement on Maria Madre. Like its mainland relative, its habits are very similar to those of the red-eyed vireo. Its favorite range was in the smaller growth of forest along the lower slopes, from near the sea up to an altitude of 600 or 700 feet, but some were seen up near the summits of Maria Madre and Maria Magdalena. Next to the Tres Marias warbler, Forrer's vireo was probably the most abundant bird on Maria Madre, and its restless habits while fluttering and peering about in search of food among the small tree tops added greatly to the animation of the forest.

Vireo forreri is evidently only a geographical race of *Vireo flavoviridis*. It has the same color pattern, but the ashy crown is paler and the dusky supraorbital stripe usually obsolescent; the latter is one of the main characters upon which *forreri* was originally based, but is not constant. Some specimens from the islands have this stripe as strongly marked as dull-colored individuals of *flavoviridis* proper, although none have it so strongly marked as some of the latter. The two forms are alike on the underparts, and the greater size of *forreri* is the most constant and striking character.

Average measurements of 17 adult males of *Vireo flavoviridis forreri:* Wing, 84.3; tail, 59.3; culmen, 15.1; tarsus, 20.1. Averages of *Vireo flavoviridis* (from mainland of Mexico): Ad. ♂ (9 specimens), wing, 79.2; tail, 55.1; culmen, 14.3; tarsus, 18.7. Ad. ♀ (3 specimens), wing, 76.6; tail, 50.6; culmen, 14.1; tarsus, 18.5.

Vireo hypochryseus sordidus Nelson. Tres Marias Vireo.

Vireo hypochryseus Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 281, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 272, 1874.

Vireo hypochryseus sordidus Nelson, Proc. Biol. Soc. Washington, XII, p. 10, 1898.

A few of these vireos were seen in the thin forest on the lower slopes of Maria Madre, but were not common. They were especially numerous among the trees and tall bushes about the few springs and little streams near the summit. A few were also seen in similar places on Maria Magdalena. *Vireo f. forreri* occupies the lower slopes, while *sordidus* occurs mainly higher up, the ranges of the two birds being complementary. The Tres Marias vireo is usually found at a medium height among the foliage of thick-topped trees, rarely ascending to the extreme top. It was also often seen in the dense, tall undergrowth near water.

Compsothlypis insularis (Lawr.). Tres Marias Parula.

Parula insularis Lawr., Ann. Lyc. Nat. Hist., N. Y., X, p. 4, 1871; Grayson, Proc. Boston Soc. Nat. Hist., XIV, pp. 278, 300, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 269, 1874.

These pretty little warblers were the most abundant of the land birds on the Tres Marias. A few of them were also found on Isabel Island, and the only *Compsothlypis* taken on the mainland at San Blas belongs to this species. They frequent the thin forest of the lower slopes on the Tres Marias, and dozens of them were seen during every visit to the woods, and they were seen in smaller numbers on the higher slopes. Many also came familiarly into the small trees and shrubbery about the houses at the settlement. They were always busily at work in pursuit of insects among the branches, and searched the bark of small shrubs near the ground as well as the branches at the tops of large trees. They were rather common in the scrubby growth of stunted trees on Isabel, and were very abundant in the tree tops of the heavy forest on the mainland between San Blas and Santiago. Their song is weak and lisping and not at all musical.

There is little doubt that a good series of specimens will demonstrate that *Compsothlypis pitiayumi* of northern South America is represented in Central America and Mexico by a number of geographical races rather than by the closely related species now recognized—*C. inornata*, *C. pulchra*, *C. nigrilora*, and *C. insularis*. Even the imperfect series at hand shows signs of intergradation, but treating *C. insularis* as a species for the present, its differences from its nearest relative, *C. pulchra*, are set forth in the following notes. *C. pulchra* was the only form found on the mainland back of the low coast plain, on the tropical or subtropical slopes of the mountains. This species was described from Chihuahua, and appears to be a resident of the lower slopes of the Sierra Madre, ranging from Chihuahua to Tepic, while *C. insularis* is characteristic of the hot lowlands on the coast near San Blas and the outlying islands.

C. insularis is larger than *C. pulchra*, with a heavier shading of brown along the flanks; the yellow of the under parts is duller and more generally suffused with dull orange brown; the white spots on outer tail feathers are decidedly larger, and the bluish of the dorsal surface is grayer. In the small series examined, difference in size seems to be the most constant character. Following are average measurements of the two species:

Measurements of Compsothlypis insularis and C. pulchra.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Compsothlypis insularis	Maria Madre Island	ad. ♂	6	60	49.3	10.4	19.9
Compsothlypis insularis	do	ad. ♀	4	55.7	47.5	10	19
Compsothlypis pulchra	Jalisco and Sinaloa	ad. ♂	3	55.6	42.3	9.6	17
Compsothlypis pulchra	do	ad. ♀	1	52	41	?	17

Dendroica æstiva rubiginosa (Pallas). Alaskan Yellow Warbler.

Several of these birds were taken and others seen about the settlement on Maria Madre. They were evidently stray migrants, and most of them left before the end of May.

Dendroica æstiva morcomi Coale. Western Yellow Warbler.

Among the yellow warblers taken on Maria Madre during the first half of May were two specimens referable to *Dendroica æstiva morcomi.* Like *rubiginosa*, they were stray migrants which had wandered out of their course while en route to their more northern breeding grounds. They were found about weed patches and shrubbery in the settlement.

Dendroica auduboni (Townsend). Audubon's Warbler.

Two of these birds were seen during the first half of May about the settlement on Maria Madre, and May 30 a specimen was taken on Maria Cleofa. Like the yellow warblers, they occur merely as stray migrants and were seen only near the seashore.

Dendroica townsendii (Townsend). Townsend's Warbler.

Two or three of these warblers were seen at the settlement on Maria Madre between the 8th and 20th of May. They kept about the weed patches and yards for several days, and were stray migrants like the preceding species.

Granatellus francescæ Baird. Tres Marias Chat-Warbler.

Granatellus francescæ Baird, Rev. Am. Birds, p. 232, 1865; Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 278, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 270, 1874.

These beautiful birds were seen only on Maria Madre, but they probably occur also on Maria Magdalena, where the conditions are equally favorable. They were far from common, and inhabited the forest on the higher slopes, but two or three individuals, evidently wanderers, were encountered in the scrubby forest near the shore. They were usually seen on the ground searching for food among low underbrush and weeds. In such places they ran about among the thick stems of plants and matted undergrowth, springing up every now and then to a twig or weed stalk a foot or two from the ground, and then perhaps flitting along from stem to stem to another feeding place a few yards away. When thus passing through the undergrowth, they are very conspicuous and attractive objects, owing to their beautifully contrasted black, white, and rose-colored plumage. Their habit of carrying the tail up-tilted and more or less widely spread renders them still more conspicuous. It is doubtful if they ascend into the tops of trees, as they are even more terrestrial than their relatives the chats.

The color pattern of this species is much like that of *G. venustus*, but the black collar on the lower side of the neck in the males is nearly obsolete, being represented only by a few black feathers, the red or rose colored area on the breast and chest is paler and more restricted, the postocular white stripe larger and extending across the nape as an indistinct nuchal band, the bluish of the dorsal surface grayer, and the white on the tail more extended. The females are browner above and paler below. *G. francescæ* is larger than *G. venustus*, as shown by the following averages:

Measurements of Granatellus francescœ and G. venustus.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Granatellus francescæ	Maria Madre Island ..	ad. ♂	5	65.8	76.5	12.2	21
Granatellus francescæ	.....do	ad. ♀	2	63	74.5	12.2	21.5
Granatellus venustus	Guerrero and Oaxaca .	ad. ♂	2	61.5	66.5	12	19.7
Granatellus venustus	.....do	ad. ♀	1	58	67	12	20.5

Wilsonia pusilla pileolata (Pall.). Pileolated Warbler.

The only one seen was taken on Maria Cleofa May 30. It was in some bushes by a little stream near the seashore and was evidently a straggling migrant.

Mimus polyglottos (Linn.). Mocking Bird.

A few mocking birds were seen on Maria Madre, where they are probably resident in small numbers. They were found only on the lower slopes near the sea. The two specimens secured appear to be identical with others from the adjacent mainland.

Thryothorus lawrencii (Ridgway). Maria Madre Wren.

Thryothorus felix Grayson, Proc. Boston Soc. Nat. Hist. XIV, p. 278, 1871 (part); Lawr., Mem. Boston Soc. Nat. Hist. II, p. 268, 1874 (part).

Thryothorus felix β lawrencii Ridgway, Bull. Nutt. Orn. Club, III, p. 10, Jan., 1878.

The song of this wren was one of the most constant and pleasing of the woodland notes heard on Maria Madre. The bird was extremely abundant everywhere in the undergrowth ranging from the shore up to the higher slopes. Like its near relatives, it is a restless little creature, constantly climbing and peering about in the thickets. The male stops every now and then to utter his song and then continues insect hunting. When in a musical mood he takes a position in some small shrub, sometimes on its summit but oftener on a branch at one side, and there pours out his song again and again at short intervals. Like many other birds on these islands, the wren was very familiar and unsuspicious, and many came every day to the fences and shrubbery around the houses at the settlement.

A series of *Thryothorus felix* from the mainland, including one specimen from the region of the type locality, and a series of *T. lawrencii* from Maria Madre, show sufficient differences to warrant giving specific rank to *lawrencii*. The latter differs very constantly in several respects from birds of the mainland, but has much the same color pattern. The series from San Blas is nearer *lawrencii* than is the specimen from near the type locality of *felix*, but there appears to be no crossing of the gap between the two.

The following measurements show the relative sizes of the two species:

Measurements of Thryothorus lawrencii and T. felix.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Thryothorus lawrencii	Maria Madre Island	ad. ♂	3	60	55.6	17.2	22
Thryothorus lawrencii	do	ad. ♀	7	57.1	54	16.8	21.4
Thryothorus felix	Santiago, Tepic to Ometepec, Guerrero.	ad. ♂	2	57.5	55.5	16	21.5
Thryothorus felix	do	ad. ♀	3	54.3	50.6	14.6	20.5

Thryothorus lawrencii magdalenæ Nelson. Magdalena Wren.

Thryothorus felix Grayson Proc. Boston Soc. Nat. Hist., XIV, p. 278, 1871 (part); Lawr., Mem. Boston Soc. Nat. Hist., II, p. 268, 1874 (part).

Thryothorus lawrencii magdalenæ Nelson, Proc. Biol. Soc. Washington, XII, p. 11, 1898.

The habits and distribution of this wren on Maria Magdalena are the same as those of *T. lawrencii* on Maria Madre. No one lives on Maria Magdalena, and the wrens are even tamer than on Maria Madre. Their confidence was shown very prettily by one encountered by Mr. Goldman in the dark bottom of a narrow rocky canyon overhung with heavy forest. He saw the little fellow busily searching for food among the fallen leaves along the base of a low cliff, and as the bird seemed very fearless he approached quietly but in full view, and succeeded in closing his hand over the tiny creature, which had continued its search without paying the slighest attention. The bird showed but little fright, and its captor, after holding it a few moments, stooped and gently opened his hand to let it escape. The wren hopped away a few feet, arranged its plumage, and then continued feeding with the utmost unconcern. Mr. Goldman watched it for a few minutes and again approached slowly. As before the bird paid no attention until he was within a yard, but when another attempt was made to pick it up, hopped away a few feet and again resumed its occupation. This was repeated three or four times with the same result, until finally the bird was left in its solitude.

Melanotis cærulescens longirostris Nelson. Tres Marias Blue Mockingbird.

Melanotis cœrulescens Grayson Proc. Boston Soc. Nat. Hist., XIV, p. 275, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 266, 1874 (part).

Melanotis cœrulescens longirostris Nelson, Proc. Biol. Soc. Washington, XII, p. 10 1898.

These fine songsters are very common on the Tres Marias. They keep in the thickets and low trees and bushes like a catbird and were especially numerous and familiar about the settlement on Maria Madre. In one yard, among a few fruit trees, a trough was kept full of water, where scores of blue mockingbirds came daily to drink and would almost allow themselves to be caught by hand. Their numbers and general distribution make them among the most noticeable birds on the islands, and they frequently follow one with much curiosity. Their song, although rich and varied, was not so clear and musical as that of their relatives on the mainland. The birds on Maria Madre show a marked tendency to albinism, which usually appears in the form of grayish or whitish bars on the wings and tail. In addition to the barring on the primaries and secondaries, the alula is often similarly marked and some specimens have lighter spots on the tips of the wing coverts, producing well-defined wing bands. The markings are usually symmetrical; but vary in amount and intensity with the individual. In some they are barely distinguishable and in others very conspicuous. More rarely the albinism appears on other parts of the body, occasionally in asymmetrical areas of pure white, but these spots also are sometimes regular. One specimen has the entire under surface white, except some blue feathers along the flanks, and the rump is white mixed with blue. This bird has a striking general resemblance to the Central American *Melanotis hypoleucus.* At least 2 or 3 per cent of the birds on the islands are albinistic, and the constant recurrence of the same light barring on the wings and tail seems to indicate the possible evolution of a form in which these markings will be constant.

Myadestes obscurus insularis Stejneger. Tres Marias Solitaire.

Myiadestes obscurus Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 277, 1871; Lawr., Mem. Boston Soc. Nat. Hist., II, p. 273, 1874.

Myadestes obscurus var. *insularis* Stejneger, Proc. U. S. Nat. Mus., IV, pp. 371, 373, 1882.

This is a common bird in the heavy forest about the heads of canyons on Maria Madre and Maria Magdalena. They were not found anywhere in the scrubby growth of the lower slopes, and if they occur there at all it must be only as stragglers. They are shy birds, remaining silent when approached, but when undisturbed flitting through the tree tops like wandering spirits of melody uttering their sweet strains from the mysterious depths of the forest. Their song was heard from the tops of tall trees where the birds sat amid the heavy foliage, rarely coming down to lower levels except in the morning or evening, or to drink at midday. Many were seen about a spring near the top of Maria Madre where they came to drink at noon.

Although *Myadestes obscurus insularis* is very closely related to *occidentalis*, yet it may be distinguished by several slight but constant characters, such as the greater extension and paler shade of ashy from the neck over the forward part of the back. The lower parts also are paler, especially on the throat and abdomen. The white tips to the tail feathers, mentioned by Dr. Stejneger as characteristic of this form, are equally common on specimens of *occidentalis*.

The following measurements show the relative size of the two forms:

Measurements of Myadestes obscurus insularis and Myadestes o. occidentalis.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Myadestes obscurus insularis.	Maria Madre Island ..	ad. ♂	5	102.7	102.6	12.2	22.5
Myadestes obscurus insularis.	.....do	ad. ♀	3	98.6	95.6	11.5	22
Myadestes obscurus occidentalis.	Jalisco and Sinaloa ...	ad. ♂	3	104	102.3	12.5	22.1
Myadestes obscurus occidentalis.	.....do	ad. ♀	2	100.5	92	12	21.7

Hylocichla ustulata (Nuttall). Russet-backed Thrush.

A typical specimen of this species, taken on the islands by Colonel Grayson in the winter of 1865, is in the National Museum. In his notes Colonel Grayson says: "I found this little thrush in the month of January quite abundant in the thickest of the woods of the Tres Marias. It is very timid and shy, more so than any bird I saw upon the islands; it frequently uttered a low, plaintive whistle, and seemed solitary in its habits." We saw none of them on the islands in May, and it is safe to class them as winter visitants.

Hylocichla ustulata swainsonii (Cabanis). Olive-backed Thrush.

Hylocichla ustulata almæ Oberholser, Auk, XV, p. 304, October, 1898.

Two specimens of this thrush were taken on Marie Madre, one on May 5, the other on May 19. They were found in the heavy forest back from the coast, and evidently occur only as stray migrants.

Mr. Oberholser mentions these specimens as typical examples of his subspecies, which is considered a synonym of *Hylocichla u. swainsonii* by the American Ornithologists' Union.

Merula graysoni Ridgway. Tres Marias Robin.

Turdus flavirostris Grayson, Proc. Boston Soc. Nat. Hist., XIV, p. 276, 1871 (part); Lawr., Mem. Boston Soc. Nat. Hist., II, p. 266, 1874 (part).

Merula flavirostris graysoni Ridgway, Proc. U. S. Nat. Mus., V, p. 12, 1882.

Grayson's robin is one of the most abundant and widely spread residents and takes the place of *M. flavirostris* of the mainland, which it closely resembles in habits and general appearance. Although a characteristic bird of the islands, yet occasional stragglers reach the mainland, as is shown by a perfectly typical specimen (a female in worn plumage) taken at Santiago, Territory of Tepic, June 20, 1897. On the islands it was found from the shore to the forests of the higher slopes and was also very plentiful and familiar about the settlement. It had a variety of notes, among them a rich warbling song and a characteristic clear, mellow, whistling call. While among the trees, or during their search for food upon the ground, these birds closely resemble the common robin in habits and general appearance. At the time of our visit a species of wild fig was in fruit, and the tops of the trees were swarming with these robins, tanagers, orioles, lovebirds, and trogons, all eagerly feeding upon the figs.

Merula graysoni is another of the Tres Marias birds which are evidently offshoots from species now resident on the adjacent mainland, but with differences sufficiently pronounced and constant to warrant their recognition as separate species. *Merula flavirostris*, the mainland representative of the Tres Marias robin, is much more richly colored than *graysoni*, and the differences mentioned by Mr. Ridgway are constant and well shown in the present series. The following average measurements show the relative dimensions of the two species:

Measurements of Merula graysoni and M. flavirostris.

Name.	Locality.	Sex.	Number of specimens.	Wing.	Tail.	Culmen.	Tarsus.
Merula graysoni	Maria Madre Island	ad. ♂	4	127	99.7	24.4	34.5
Merula graysoni	do	ad. ♀	5	125.6	98.8	24	34.5
Merula flavirostris	West coast Mexico	ad. ♂	4	125	99.7	21	32.6
Merula flavirostris	do	ad. ♀	5	124.4	98	23	32.4

BIRDS ERRONEOUSLY ATTRIBUTED TO THE TRES MARIAS.

Among the birds sent to the Smithsonian Institution from western Mexico by Mr. John Xantus are five species of humming birds named below which were not found on the Tres Marias either by Colonel Grayson or myself, and which are not known even from the adjacent parts of the mainland. These specimens are now in the National Museum, all labeled "Tres Marias, July, 1861." The improbability of their capture on the Tres Marias is very great, and the fact that species from such widely separated areas should be credited to these islands during a single month can be accounted for in only one way. Probably Mr. Xantus purchased these specimens from some one who misled him concerning their origin. That this could be done very easily I know from personal experience. Some years ago I purchased a small collection of birds from a San Francisco dealer, who claimed that they came from

La Paz, Lower California, but which proved to be made up of species found near Mazatlan, Sinaloa.

Thalurania luciæ Lawr.

Thalurania luciæ Lawr., Ann. Lyc. Nat. Hist., N. Y., VII, p. 2, 1867; Proc. Boston Soc. Nat. Hist., XIV, p. 284, 1871; Mem. Boston Soc. Nat. Hist., II, p. 291, 1874.

Described as new from the specimen sent in by Xantus, but proved to be *Thalurania glaucopis*, a resident of southeastern Brazil.

Florisuga mellivora (Linn.).

Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 284, 1871; Mem. Boston Soc. Nat. Hist., II, p. 291, 1874.

A well-known species of the humid tropics from southern Mexico to South America. There is no authentic record for it in western Mexico, and it is safe to say it has not been taken on the Tres Marias.

Uranomitra guatemalensis (Gould).

Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 284, 1871; Mem. Boston Soc. Nat. Hist., II, p. 292, 1874.

A species which ranges from Guatemala and British Honduras southward. There is no authentic Mexican record.

Petasophora thalassina (Swainson).

Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 284, 1871; Mem. Boston Soc. Nat. Hist., II, p. 292, 1874.

This humming bird ranges from the highlands about the Valley of Mexico southward into Central America, but there appears to be no authentic record for western Mexico.

Chlorostilbon insularis Lawr.

Chlorostilbon insularis Lawr., Ann. Lyc. Nat. Hist. N. Y., VII, p. 457, 1867; Proc. Boston Soc. Nat. Hist., XIV, p. 284, 1871; Mem. Boston Soc. Nat. Hist., II, p. 292, 1874.

This bird was described by Mr. Lawrence from a Xantus specimen, but proved to be *Chlorostilbon pucherani* of southeastern Brazil.

Merula grayi Lawr.

Merula grayi Lawr., Proc. Boston Soc. Nat. Hist., XIV, p. 276, 1871; Mem. Boston Soc. Nat. Hist., II, p. 266, 1874.

Grayson's notes on *Merula grayi* on the Tres Marias refer to pale specimens of *M. graysoni*, and his record of *M. grayi* at the city of Tepic, on the adjacent mainland, refers to *M. tristis*. *Merula tristis* is a common and widely spread species in suitable localities in western Mexico and is the only *Merula* sent in by Grayson from the city of Tepic.

Merula grayi, on the contrary, does not appear to occur anywhere in western Mexico north of the Isthmus of Tehuantepec, for no specimens were taken by Grayson nor, during our own work at many localities between the Isthmus and Mazatlan, has a single individual been noted, and there appears to be no authentic record of its occurrence there. This thrush is a species of the humid tropics, ranging along both coasts of Central America north to the Isthmus of Tehuantepec, and thence northward its range is limited to the humid region of the Gulf coast and adjacent mountain slopes of eastern Mexico.

REPTILES OF THE TRES MARIAS AND ISABEL ISLANDS.

By Leonhard Stejneger,

Curator, Division of Reptiles and Batrachians, U. S. National Museum.

The present paper is based upon the collection made on the Tres Marias and Isabel Islands in April and May, 1897, by E. W. Nelson and E. A. Goldman.

The surprising fact that the two expeditions which have collected systematically in the Tres Marias brought home the same number of species, Forrer only collecting one snake, *Diplotropis diplotropis*, which Nelson did not collect, and Nelson also collecting only one snake which Forrer did not obtain, viz, *Boa imperator*, seems to indicate that not many more species than the 16 here enumerated are to be found in these islands.

It will thus be seen that the reptile fauna is an exceedingly poor one and very disappointing in several respects. Thus most of the species are common on the opposite mainland and generally distributed over tropical Mexico and Central America. Then, again, it seems as if the species are practically identical on all the islands of the group. This would indicate a comparatively recent severance of the islands from each other as well as from the opposite mainland of Mexico.

It is worthy of note, perhaps, that there is absolutely no indication of relation to the Cape Saint Lucas fauna of Lower California. The only species occurring in both places is *Phyllodactylus tuberculosus*, a gecko of wide distribution, the presence of which is of absolutely no moment in determining zoogeographical relations.

The only species whch seems to be peculiar to the islands is *Cnemidophorus mariarum*. As will be explained more fully under the head of this species, I have never seen a specimen from the mainland, and those which have been recorded from there I regard as wrongly identified. However, the herpetology of the regions in question is too little explored in detail to incline one to be dogmatic on a point like this, but I may call attention to the fact that the swift which occurs on the little Isabel Island, about halfway between the Tres Marias and the mainland, is most certainly the same form which inhabits the latter, viz, *Cnemidophorus gularis mexicanus*, and not *C. mariarum*, to which it bears only a superficial resemblance. The species collected on Isabel Island are referred to in the following paper without any number preceding the specific names. Mr. Nelson has contributed field notes on some of the species, and these notes are given in brackets with his initials at the end of the paragraph on the species to which they refer.

TESTUDINATA.

[The tortoise-shell turtle frequents the sea about the Tres Marias, approaching the shores to mate and deposit eggs in May and June each year. At the same time the large green sea turtle abounds along these shores, where they congregate for the same purpose.—E. W. N.]

Kinosternon integrum Leconte.

I have no hesitation in endorsing Boulenger's view (Cat. Chel. Brit. Mus., p. 42) that the Tres Marias mud turtles are *K. integrum* and not *K. hirtipes*, as held by Günther (Biol. Centr.-Am., Rept., p. 15, pls. xii–xiv). They have the broader bridge and broader plastron of the former and agree with undoubted specimens from the mainland. The island specimens, of which there are four adults and one young, do not differ from those from Colima, Guanajuato, Cuernavaca (Morelos), Acaponeta (Tepic), Guadalajara (Jalisco), Presidio, and Mazatlan (Sinaloa), from all of which localities I have examined specimens. *K. hirtipes* I believe to be confined to the eastern side of Mexico.

List of specimens of Kinosternon integrum.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24606	712	Maria Madre Island	May 15, 1897
24607	713	do	May 15, 1897
24608	714	do	May 15, 1897
24609	715	do	May 15, 1897
24610	716	do	May 15, 1897

LORICATA.

Crocodylus americanus Laur.

No specimens were secured, but Mr. Nelson assures me that the crocodile occurs on Maria Magdalena Island. There can be but little doubt that it is the present species which is distributed all along the coast of Central America, Mexico, the West Indies, and southern Florida.

[The unmistakable furrow in the mud where a crocodile had hauled up on the border of a brackish lagoon on the eastern side of Maria Magdalena, the sight of a small head in the water, and the testimony of the people on Maria Madre established the fact of their occurrence. They appeared to be limited to Maria Magdalena.—E. W. N.]

SQUAMATA.

SAURI.

Phyllodactylus tuberculosus Wiegm.

This species is distributed over Mexico and Central America, and has also been collected in the Cape Saint Lucas region of Lower California, the specimens from the latter locality having been described by Cope as *Phyllodactylus xanti.*

List of specimens of Phyllodactylus tuberculosus.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24611	669	Maria Madre Island	May 21, 1897
24612	[1] 686	do	May 28, 1897
24613	700	Maria Cleofa Island	May 30, 1897

[1] No. 686 was taken in an old house.

Anolis nebulosus Wiegm.

All the specimens from the three islands are normally colored and alike, except No. 692, which has a wide whitish dorsal band originating on the occiput and extending down the upper surface of the tail. It is edged with dusky, and a narrow broken line of the same dusky color in the white band near the edge on each side extends from neck to rump. This specimen is small and without gular pouch; but No. 691, from the same island, which equals it in these respects, is colored like the larger specimens. Both specimens appear to be females, having no enlarged postanal scales.

This species is widely distributed over Mexico, and has been collected in the Tres Marias Islands not only by Forrer but also by Capt. William Lund, specimens from the latter being in the museum of the California Academy of Sciences in San Francisco (Van Denburgh, Proc. Phila. Acad., 1897, p. 460).

List of specimens of Anolis nebulosus.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24614	636	Maria Madre Island	May 3, 1897
24615	641	do	May 4, 1897
24616	[1] 683	Maria Magdalena Island	May 28, 1897
24617	[1] 684	do	May 28, 1897
24618	[1] 685	do	May 28, 1897
24619	688	do	May 28, 1897
24620	690	Maria Cleofa Island	May 29, 1897
24621	691	do	May 29, 1897
24622	692	do	May 29, 1897

[1] Nos. 683–685 were found living in an old house.

Ctenosaura teres (Harlan). Black Iguana.

The material at hand is very unsatisfactory inasmuch as all the full-grown specimens are of the same sex and in rather poor state of preservation, while the younger specimens afford no characters for satisfactorily separating the various forms which naturally group themselves around *Ctenosaura teres*. They are therefore left under that general name for the present, the writer hoping some day to be able to review the whole genus. The chief difficulty now lies in the lack of typical specimens of *C. teres* from Tampico and from the eastern coast of Mexico generally, and until a series of full-grown specimens of both sexes is obtained from that region it will be futile to attempt to straighten out the nomenclature of these lizards. As far as I can make out from my defective material the Tres Marias and Isabel specimens differ sufficiently from specimens from Colima and Tehuantepec to warrant their subspecific recognition, but whether identical with the Mazatlan form or not I am not able to say. There are certainly several pretty well defined races of this species; but more adult specimens and a direct comparison with the types of many of the old names in various foreign museums will be necessary before the intricate questions involved can be settled.

[The females were burrowing in the gravel in dry washes and flats on the islands the last half of May. The burrows were from 2 to 3 or 4 feet deep, and after the eggs had been deposited at the lower end, the female scraped in loose gravel until the hole was filled, and frequently raised a little mound over the entrance.—E. W. N.]

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24623	655	Maria Madre Island	May 14, 1897
24624	656	......do	May 14, 1897
24625	659	......do	May 15, 1897
24626	660	......do	May 15, 1897
24627	662	......do	May 15, 1897
24628	(bis) 662	......do	May 17, 1897
24629	676	......do	May 24, 1897
24630	693	Maria Cleofa Island	May 29, 1897
24631	630	Isabel Island	Apr. 23, 1897
24632	631	......do	Apr. 23, 1897
24633	632	......do	Apr. 23, 1897

Uta lateralis Boulenger.

Mr. Nelson remarks that this species lives on stones and driftwood near the border of the woods along the sea beaches.

Uta lateralis was based by Boulenger in 1883 upon specimens from the Tres Marias and from Presidio, near Mazatlan, collected by Forrer, and specimens from both localities are designated as 'types' in the 'Catalogue of Lizards in the British Museum.'

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24634	635	Maria Madre Island	May 3, 1897
24635	642	....do	May 4, 1897
24636	643	....do	May 7, 1897
24637	653	....do	May 13, 1897
24638	670	....do	May 21, 1897
24639	671	....do	May 21, 1897
24640	672	....do	May 21, 1897
24641	673	....do	May 21, 1897
24642	674	....do	May 21, 1897
24643	675	....do	May 21, 1897
24644	678	....do	May 25, 1897
24645	679	....do	May 25, 1897

Sceloporus boulengeri Stejneger.

N. Am. Fauna No. 7, 1893, p. 180, pl. I, figs. 5*a–c*.

This species appears to be smaller than *S. clarkii*, of which it is the southern representative. A full-grown male (No. 634*e*) measures only 72^{mm} from snout to vent.

Van Denburgh's belief that *S. boulengeri* "is the same form as Cope's *S. oligoporus*" (Proc. Phila. Acad., 1897, p. 463) is not well founded. The latter is easily distinguished by having only 2 to 3 femoral pores, besides other differences. It is probably identical with *S. horridus*.

U. S. National Museum number.	Collectors' number.	Locality.	Sex.	Number of pores.	Date.
24646	634	Isabel Island	♂ ad	8	Apr. 23, 1897
24647	634 *a*	....do	♀ jun	9	Apr. 23, 1897
24648	634 *b*	....do	♂ adol	7	Apr. 23, 1897
24649	634 *c*	....do	♀ ad	9	Apr. 23, 1897
24650	634 *d*	....do	♀	9	Apr. 23, 1897
24651	634 *e*	....do	♂ ad	9	Apr. 23, 1897

Cnemidophorus mariarum Günther.

Cnemidophorus mariarum Günther Biol. Cent.-Am., Rept. p. 28, pl. XX, April, 1885; Boulenger, Cat. Lizards, Brit. Mus., p. 368, 1885.

The swifts from the Tres Marias are essentially alike. Those from Maria Madre are the largest and possibly also most distinctly marked; those from the small detached rock off the west side of Maria Cleofa as well as the one from the main island of that name are somewhat smaller. According to Mr. Nelson's observation those from the detached islet, which is a bare rock, the nesting place of numerous sea birds, appeared to him paler when alive than those on the other islands, but now, in alcohol, the difference, if any, is very slight.

This species, which was originally described by Günther from specimens collected by Forrer on the Tres Marias seems to be confined to this group of islands. If so, it is the only species of reptile hitherto collected which is peculiar to these islands. The species has been recorded from the mainland (by Van Denburgh, Proc. Phila. Acad., 1897, p. 463, who identifies "a large number of lizards from Mazatlan, San Blas, and Tepic" with Günther's species), but I am satisfied that these records are based upon specimens of *C. gularis mexicanus* (Peters) which superficially very much resemble the island species. The misidentification is probably due to the fact that Cope, in his monograph of the genus, overlooked the different keeling of the caudal scales which is the essential character of this species.

List of specimens of Cnemidophorus mariarum.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24652	637	Maria Madre Island	May 3, 1897
24653	638	.....do	May 3, 1897
24654	639	.....do	May 4, 1897
24655	640	.....do	May 4, 1897
24656	644	.....do	May 7, 1897
24657	645	.....do	May 7, 1897
24658	646	.....do	May 7, 1897
24659	647	.....do	May 7, 1897
24660	687	Maria Magdalena Island	May 28, 1897
24661	701	Maria Cleofa Island (outlying rock)	May 30, 1897
24662	702	.....do	May 30, 1897
24663	703	.....do	May 30, 1897
24664	704	.....do	May 30, 1897
24665	705	.....do	May 30, 1897
24666	706	Maria Cleofa Island (main island)	May 31, 1897

Cnemidophorus gularis mexicanus (Peters).

The Isabel Island swifts are identical with the mainland form, two specimens of which were brought from San Blas. They are quite distinct from the species on the Tres Marias, which is well characterized by the smaller femorals and the parallel caudals. It is strange that Cope, having had the latter character clearly pointed out by Boulenger, should have referred *C. mariarum* to *C. gularis* as a subspecies.

List of specimens of Cnemidophorus gularis mexicanus.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24667	633	Isabel Island	April 23, 1897
24668	633*a*	.....do	April 23, 1897
24669	633*b*	.....do	April 23, 1897
24670	633*c*	.....do	April 23, 1897
24671	633*d*	.....do	April 23, 1897

SERPENTES.

Boa imperator Daudin.

This is the first record of this species from the Tres Marias. The species is generally distributed through southern Mexico and Central America.

Scale rows 73.

List of specimens of Boa imperator.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24672	648	Maria Madre Island	May 12, 1897

Oxybelis acuminatus (Wied).

A common species occurring all through tropical America from Guaymas, Mexico, south.

List of specimens of Oxybelis acuminatus.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24673	677	Maria Madre Island	May 25, 1897

Diplotropis diplotropis (Günther).

This species seems to be confined to western Mexico. It was not collected by Mr. Nelson, but there are two specimens in the British Museum collected by Forrer on the Tres Marias (*Leptophis diplotropis* Boulenger, Cat. Snakes Brit. Mus., II, p. 110).

Drymobius boddaerti (Seetzen).

A common species distributed over tropical America.

In No. 681 the fourth labials on both sides are divided horizontally, so as to suggest a subpreocular. This is an adult male, and is uniformly colored above, without any markings. The adolescent specimens are uniform above, with a few scales tipped with black; the anterior part of the underside has square blackish spots. The two young ones have above brown, dark-edged, squarish spots, separated by narrow light-colored interspaces. They are marked underneath like the adolescent specimens.

No. 681, male ad.—Scale rows, 17; ventrals, 183; anal, $\frac{1}{2}$; caudals, $\frac{111}{111}$; supralabials, 9.

List of specimens of Drymobius boddaerti.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24674	652 juv.	Maria Madre Island	May 12, 1897
24675	654 ad.	do	May 13, 1897
24676	658 ad.	do	May 14, 1897
24677	661 ad.	do	May 15, 1897
24678	663 juv.	do	May 18, 1897
24679	681 ad.	Maria Magdalena Island	May 27, 1897

Bascanion lineatum Bocourt.

This species is apparently confined to western Mexico.

List of specimens of Bascanion lineatum.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24680	650	Maria Madre Island	May 12, 1897
24681	651	do	May 12, 1897
24682	660	do	May 16, 1897

Drymarchon corais melanurus (Dum. & Bibr.)

Scale rows, 19; ventrals, 205; anal, 1; caudals, $\frac{83}{83}$, supralabials, 8. Adult male with the characteristic coloring of this subspecies, which seems to be confined to Mexico and Central America.

List of specimens of Drymarchon corais melanurus.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24683	664	Maria Madre Island	May 18, 1897

Lampropeltis micropholis oligozona (Bocourt).

Scale rows, 23; ventrals, 230; anal, 1; caudals, $\frac{51}{51}$; temporals, 2 + 3. Adult male. Thirteen annuli on body, separated by wide, red interspaces, without black spots, both on back and belly; all the annuli complete, including that on neck and throat, which does not touch the parietals; snout white, with black on rostral and anterior nasal. From Boulenger's account it appears that Forrer's specimens from the Tres Marias are identical. (Cat. Snakes Brit. Mus., II, p. 204.)

Distributed over Mexico and Central America.

List of specimens of Lampropeltis micropholis oligozona.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24684	661	Maria Madre Island	May 16, 1897

Agkistrodon bilineatus (Günther).

Scale rows, 23; ventrals, 138; anal, 1; caudals, $21 + \frac{25}{25}$. Adult male.

Southern Mexico and Central America to Nicaragua.

List of specimens of Agkistrodon bilineatus.

U. S. National Museum number.	Collectors' number.	Locality.	Date.
24685	707	Maria Madre Island	May 15, 1897

Crotalus sp.?

No rattlesnake was collected on the Tres Marias by Forrer, nor by Nelson, but the latter informs me that he was told of the occurrence of a rattler on Maria Magdalena Island.

NOTES ON THE CRUSTACEA OF THE TRES MARIAS ISLANDS.

By Mary J. Rathbun,

Second Assistant Curator, Division of Marine Invertebrates, U. S. National Museum.

Of the four species of crustacea taken by E. W. Nelson and E. A. Goldman on the Tres Marias Islands in May, 1897, two are identical with forms inhabiting Lower California, one is found in all the warm countries of the world, while the fourth, a fresh-water shrimp, is distributed throughout tropical America.

Gecarcinus digueti Bouvier.

Gecarcinus digueti Bouvier, Bull. Mus. Hist. Nat., Paris, I, 8, 1895.

Maria Cleofa Island. May 30. One large male (Collectors' No. 717).

The type and only specimen hitherto collected is from Lower California, and is in the Paris Museum. This species differs from others found on the Pacific coast in its wider carapace, narrower front, longer legs, and in the form of the abdomen of the male.

Measurements.

Specimen.	Length.	Width.	Exorbital width.	Inferior width of front.	Length of merus of second ambulatory leg.	Width of same.	Length of carpus.	Width of same.	Length of propodus.	Width of same.	Length of dactylus.	Width of same.
Type, ♂, Lower California	46.3	69	25	9	33	9.7	16	8	17	7.3	24.2	3.7
♂, Maria Cleofa Island	70	104	37.5	13	46.3	13.4	22.5	11.5	21.5	10	33.5	5

The measurements of the legs are exclusive of the large spines, and the length given is that of the anterior or superior margin. The penultimate segment of the abdomen of the male is very wide. Length and distal width, 12 mm.; proximal width, 21.5.

Mr. Nelson says of these crabs:

> On the Tres Marias we found them only on Maria Cleofa, where they were very numerous above high-water mark on the sandy beaches of the low eastern part of the island. They were also living very abundantly in burrows in the soft soil almost everywhere on the slopes of Isabel Island. They are nocturnal in habits, and caused

some annoyance by walking over us at night while we were camped in their haunts. They began to come out of their burrows as soon as it became twilight in the evening. In both localities most of their burrows were found among the scrubby bushes. On Isabel Island they were often seen during the day sitting in the burrows a foot or so from the entrance, but scuttled back to a safe depth when I approached.

Ocypode[1] **occidentalis** Stimpson.

Ocypoda occidentalis Stimpson, Ann. Lyc. Nat. Hist. N. Y., VII, 229, 1860.

Maria Magdalena Island. May 28. One female (No. 689).
Maria Cleofa Island. May 30. One male (No. 699).

This much neglected species is distinct, it seems to me, from *O. kuhlii* de Haan, of which Miers made it a variety. According to the description of *O. kuhlii* given by de Man (Notes Leyden Mus., III, 250, 1881), who had the type before him, *O. occidentalis* differs from it in having a narrower carapace, in the outer orbital angle directed inward and not outward, in the shorter hand, the length of the upper margin of the palm being less than the width, and in having from 18 to 21 tubercles in the stridulating ridge (de Man gives 8 or 10 for *kuhlii*, while Miers figures 17). The form of the abdomen of the male furnishes excellent characters for the determination of the species of *Ocypode*. In *O. occidentalis* the penultimate segment is much wider at its middle than at its proximal end.

It is singular that this species is not mentioned in the revisions of the genus by Kingsley, 1880, or by Ortmann, 1897.

Dimensions of a type specimen, U. S. National Museum.—Male: Length, 40.5 mm.; epibranchial width, 48; exorbital width, 41; length of superior margin of palm, 22.8; entire length of propodus, 43.5; greatest width, 24.

Range.—Type locality, Cape St. Lucas. Also taken at Turtle Bay and San Jose del Cabo, Lower California, by Mr. A. W. Anthony, in 1896 and 1897.

Grapsus grapsus (Linnæus).

"This crab was very abundant on the rocks along the water's edge on the Tres Marias as well as on Isabel Island." (Nelson.)

The species is distributed throughout the tropics.

Bithynis jamaicensis (Herbst).

Maria Magdalena Island. May 27. One adult, 7 young (No. 709).
Maria Cleofa Island. May 30. One adult, 3 young (No. 710).

"These shrimps were very numerous in a small stream among the hills in the interior of Maria Magdalena, and were also numerous in streams flowing through the hilly parts of the adjacent mainland." (Nelson.)

The species is found on the Pacific slope of the continent from Lower California to Ecuador, and on the Atlantic slope from Texas to Rio de Janeiro. The following localities, not before recorded, are represented by specimens in the U. S. National Museum: On the Pacific coast, La Paz, Lower California; Rio Presidio, Sinaloa; Rio de Alica, Tepic; Barranca Ibarra, Rio Santiago, Jalisco, and Rio Armeria, Colima, Mexico; Rio de los Platanales and Quebrada Chavarria Golfito (both tributary to the Gulf of Dulce), Costa Rica; River David, Chiriqui, United States of Colombia, 4,000 feet elevation; Guayaquil, Ecuador. On the Atlantic coast, San Antonio, Tex.; Las Moras Creek, Kinney County, Tex.; Brownsville, near mouth of Rio Grande, Tex.; Amixtlan, and Zacatlan, Puebla, Mexico; Escondido River, 50 miles from Bluefields, Nicaragua; Port Castries, St. Lucia, West Indies.

---

[1] *Ocypode,* not *Ocypoda,* Fabricius, Entom. Sys., Suppl., 312 and 347, 1798; also Entom. Sys., emend. et auct., IV, index, 115, 1796.

The west African form, *B. vollenhovenii* (Herklots) is no more than a subspecies of *B. jamaicensis.* It differs only in the slenderer second pair of feet, the carpal and meral joints of which are subequal. The relative lengths of the rostrum and the antennal scales and peduncles agree with those in some specimens of *jamaicensis.* The two forms are considered identical by Dr. Ortmann.

According to Dr Edward Palmer, *B. jamaicensis* is much eaten at Colima, and is offered in the market there as a choice article of food, especially on Fridays and Sundays.

PLANTS OF THE TRES MARIAS ISLANDS.

By J. N. Rose,
Assistant Curator, Division of Plants, U. S. National Museum.[1]

The Tres Marias, lying about 65 miles off the west coast of Mexico in about 22° north latitude, are among the last of the west coast islands to be studied. All the others have yielded valuable botanical results, but almost nothing has been known of the flora of these islands except in a commercial way. Several botanical expeditions had been planned to explore the islands, but heretofore none had succeeded in reaching them. They are out of the line of traffic, although some of the smaller steamers stop now and then for fuel, and small boats occasionally ply between the islands and San Blas. They are usually visited during the dry season, as it is dangerous to attempt the passage during summer and autumn.

Mr. Nelson visited the islands at the very close of the dry season, when the vegetation is at its poorest, and this accounts for the small number of species collected. His collection contains 154 numbers (Nos. 4179 to 4333) and 136 species, mostly from Maria Madre, the largest of the islands, and only a few from Maria Magdalena and Maria Cleofa. In the subjoined list the plants are from Maria Madre unless otherwise stated.

There are no cultivated plants on the islands, except one or two grasses. *Pithecolobium dulce*, perhaps introduced, is common and much prized for its delicious fruit. The exportation of Spanish cedar (*Cedrela* sp.) has long been the chief source of income for the islands, but the available supply of this timber is now nearly exhausted. The flora is purely tropical and does not differ essentially from that of the adjacent mainland. Many of the species have not been reported from the mainland opposite, but this is doubtless because the flora is not well known, since these species have been collected either farther north or south. One hundred and twelve species are named below, of which 11 are new. Many of them have a wide distribution in tropical America; all but 6, except the new species, have heretofore been reported from Mexico; 24 range northward into the United States; 64 extend into Central America; 61 into South America; 44 into the West Indies, and 21 are found in the Old World.

---

[1] Published by permission of the Secretary of the Smithsonian Institution.

The following report must be regarded as a preliminary one. The specimens upon which it is based are simply those in fruit or flower at the close of the dry season, a considerable number of which have not been determined specifically and a few not even generically. As will be seen from the list below, mostly trees and shrubs were collected, while the herbs, which spring up in great variety during the rainy season, are scarcely represented.

The Gamopetalæ and Apetalæ have been named by Mr. J. M. Greenman, Gramineæ by Prof. F. Lamson-Scribner, and Filices by George E. Davenport.

The following new species and varieties are based on this collection:

Ægiphila pacifica Greenman.
Beloperone nelsoni Greenman.
Buxus pubescens Greenman.
Cordia insularis Greenman.
Erythrina lanata Rose.
Euphorbia nelsoni Millspaugh.
Euphorbia subcœrulea tresmariæ Millsp.
Gilibertia insularis Rose.
Pilocarpus insularis Rose.
Ternstrœmia maltbya Rose.
Zanthoxylum insularis Rose.
Zanthoxylum nelsoni Rose.

ANNOTATED LIST OF SPECIES.

Cissampelos pareira L.

Common in Mexico and other tropical countries. May 3 to 25 (Nos. 4233 and 4262).

Argemone ochroleuca Sweet.

Widely distributed throughout Mexico. Maria Magdalena Island, May 26 to 28, 1897 (No. 4318).

Capparis cynophallophora L.

Found along the coast of Mexico, South America, and the West Indies. May 3 to 25 (No. 4302).

Capparis breynia L.

Common in Mexico, South America, and the West Indies. May 3 to 25 (No. 4219).

Cratæva tapia L.?

Perhaps this is the species which has been reported from Acapulco and Mazatlan. May 3 to 25 (No. 4274.)

Ternstrœmia maltbya Rose, sp. nov.

Tree 3 to 9 meters high; leaves obovate, entire, obtuse, glabrous, thickish, not black-punctate beneath, 5 to 10 cm. long; flowers solitary; peduncles 2.5 to 3.5 cm. long becoming curved, bracteate a short distance below the calyx; sepals 5, orbicular, 8 to 10 mm. in diameter; petals united at base, acute; stamens numerous; fruit (immature) ovate, 20 mm. long, two-celled; seeds red.

This species is in all probability Seeman's No. 2148, collected on the road from Mazatlan to Durango and enumerated in the Biologia Centrali-Americana without specific name.

Collected on Maria Madre Island, May, 1897, by T. S. Maltby (No. 105) and E. W. Nelson (No. 4242); by J. N. Rose near Colomo, Sinaloa, July, 1897 (No. 1675).

Wissadula hirsutiflora (Presl) Rose.

The type of this species came from Acapulco. It is probably common on the west coast, although its distribution and specific limits are not well known. May 3 to 25 (No. 4250).

Abutilon reventum Watson.

This species extends as far north as Arizona. May 3 to 25 (No. 4203).

Hibiscus tiliaceus L.

A common tree in most tropical countries. Maria Magdalena Island, May 26 to 28 (No. 4328a).

Melochia tomentosa L.

Common throughout tropical America. May 3 to 25 (No. 4205).

Guazuma ulmifolia Lam.

Common throughout tropical America. Maria Magdalena Island, May 26 to 28 (No. 4325).

Heteropterys floribunda H. B. K.

Common in Mexico and Central America.

Maria Magdalena Island, May 26 to 28 (No. 4323).

Guaiacum coulteri ? Gray.

Seemingly common on the west coast of Mexico. Island specimens do not correspond with the form found on the mainland and may represent an undescribed species. May 3 to 25 (No. 4180).

Zanthoxylum insularis Rose, sp. nov.

Tree 6 to 20 meters high, thornless; leaves oddly pinnate; leaflets 6 to 7 pairs, opposite, sessile, obovate to spatulate, obtuse or retuse, 2 to 3.5 cm. long, crenate, with large pellucid dots between the teeth and small scattered dots over the surface, glabrous; flowers unknown; fruit small, in a rather compact panicle; pedicels very short; stipe short and thick.

Collected by E. W. Nelson on Maria Madre Island. May 3 to 25, 1897 (No. 4278).

Zanthoxylum nelsoni Rose, sp. nov.

Tree 7.5 to 20 meters high, thornless(?); leaves oddly pinnate; leaflets about 6 pairs, distant, opposite, shortly petioled, 5 to 11 cm. long, rounded at base, long-acuminate, crenate, glabrous on both sides, thickly set with pellucid dots; inflorescence in small compact panicles; perianth complete; petals 4 (?); fruit large in dense head-like clusters, not stipitate.

A very peculiar species, unlike any Mexican one known to me. Collected by E. W. Nelson on Maria Madre Island. May 3 to 25, 1897 (No. 4279).

Pilocarpus insularis Rose, sp. nov.

Tree 3 to 6 meters high, glabrous throughout; leaflets usually in threes, some solitary or in rows, 5 to 7.5 cm. long, retuse at apex, cuneate at base, in the lateral ones more or less oblique; midvein prominent, lateral veins indistinct below, not very prominent above; racemes short and compact, 5 to 10 cm. long; fruiting pedicels horizontal, 16 mm. long; ovary deeply 4 or 5-lobed or parted, 1 to 4 lobes not maturing.

This species is near *P. longipes* of Mexico, but with somewhat different leaves, more compact inflorescence, etc. Collected by E. W. Nelson on Maria Madre Island. May 3 to 25, 1897 (No. 4307).

Amyris sp.

May 3 to 25, 1897 (No. 4237).

Picramnia sp.

A tree 4.5 to 7.5 meters high; flowers said to be greenish, but none with specimens. Much resembling the South American species *P. ciliata* Mast., but without flowers or fruit. Exact identification is doubtful. May 3 to 25 (No. 4276).

Ochna sp.

May 3 to 25 (No. 4238).

Bursera gummifera Jacq.

Common throughout tropical Mexico, Central America, the West Indies, and extending into Florida. May 3 to 25 (No. 4227).

Guarea sp.

May 3 to 25 (Nos. 4222 and 4230).

Trichilia spondioides Swartz.

Common in tropical America. May 3 to 25 (Nos. 4214 and 4309).

Ximenia americana L.

Common in most tropical countries. May 3 to 25 (No. 4224).

Schœpfia schreberi Gmel.

Seemingly rare, but has been collected in Mexico and South America. May 3 to 25, 1897 (No. 4271).

Hippocratea sp.

Maria Magdalena Island, May 26 to 28 (No. 4320). Maria Madre Island, May 3 to 25 (No. 4226).

Colubrina arborea Brandegee.

Reported from Lower California and the west coast of Mexico. May 3 to 25 (No. 4213).

Cissus sicyoides L.

A common species in tropical America. May 3 to 25 (No. 4198).

Serjania mexicana Willd.

A common species in tropical America. May 3 to 25 (No. 4231).

Paullinia sessiliflora Radl.

Heretofore only known from the type specimens collected by Dr. Edward Palmer in the State of Colima, Mexico. May 3 to 25 (No. 4210).

Urvillea ulmacea H. B. K.

Common in Mexico and northern South America. May 3 to 25 (No. 4277).

Cardiospermum corindum L.

A widely distributed species. Maria Magdalena Island, May 26 to 28 (No. 4328).

Crotalaria lupulina ? H. B. K.

Perhaps this species, which is common in Mexico, and extends into the United States. May 3 to 25 (No. 4248).

Tephrosia sp.

May 3 to 25 (No. 4193).

Desmodium sp.

May 3 to 25 (No. 4287).

Erythrina lanata Rose, sp. nov.

A small tree, 4.5 to 7.5 meters high, with a trunk 10 cm. in diameter; branches glabrous, bearing mostly single infrastipular spines; leaflets triangular, shortly acuminate, 5 to 10 cm. long, 5 to 7.5 cm. broad, glabrous or nearly so.

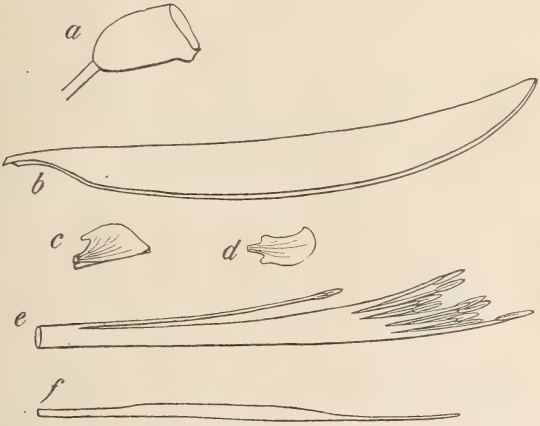


FIG. 1.—*Erythrina lanata*; *a*, calyx; *b*, banner; *c*, keel; *d*, wing; *e*, stamens; *f*, ovary.

Inflorescence unknown; calyx lanate becoming glabrate, tubular, 10 to 13 mm. long, truncate, one-toothed; banner 68 mm. long, folded, densely white-lanate, rounded at apex; wings (9 mm. long) and keel (10 mm. long) included within the calyx; ovary densely lanate; legume glabrous, 12.5 to 15 cm. long, strongly constricted between the seeds, long-stipitate, attenuate at tip; seeds small (for the genus), nearly orbicular, 6 to 8 mm. long, bright scarlet, with a dark spot at the micropyle.

The type of this species is Dr. Edward Palmer's No. 129, from Acapulco, Mexico, collected in 1894–95. To this species I would refer specimens collected by Frank Lamb near Villa Union, State of Sinaloa, January, 1893 (No. 428), and flowering specimens by W. C. Wright from the head of Mazatlan River, January, 1889 (No. 1292), and also those collected by J. N. Rose at Rosario, Sinaloa, July 10, 1897 (No. 1592), and July 22 (No. 1822). The latter two specimens are not in flower and their reference here is attended with some doubt. The seeds are larger and the pods less constricted between the seeds. Here also belongs E. W. Nelson's No. 4303 from the Tres Marias, collected May, 1897. I have tentatively referred to this species E. W. Nelson's No. 2699, taken at an altitude of 480 meters, near Santo Domingo, State of Oaxaca, June 18, 1895. It has similar pods, but is described as being but 6 to 12 cm. high and has more bluntish leaflets.

Dr. Palmer says this tree flowers in January, and is often used for hedge fences. It differs from all other Mexican species which I have seen in its white lanate banner. Its one-toothed calyx suggests *E. rosea*, but in the latter the calyx is described as obliquely truncate.

Phaseolus sp.

Maria Magdalena Island, May 26 to 28, 1897 (No. 4319).

Canavalia gladiata DC.

A species of wide distribution, perhaps throughout tropical America. May 3 to 25 (No. 4190).

Rhynchosia minima DC.

A common Mexican species extending into South America and the United States. May 3 to 25 (No. 4206).

Rhynchosia precatoria (?) (H. B. K.) DC.

This species has been reported from Acapulco and Panama. May 3 to 25 (No. 4179).

Lonchocarpus sp.

May 3 to 25 (No. 4310).

Ateleia (?) sp.

Without flowers or named specimens for comparison it is impossible to name this plant definitely. If it belongs to the genus *Ateleia* it is perhaps *A. pterocarpa*, the only species known from Mexico. A shrub or small tree 3.5 to 10.5 meters high. May 3 to 25 (No. 4186).

Cassia emarginata L.

Common in Mexico, South America, and the West Indies. May 3 to 25 (Nos. 4192 and 4297).

Cassia biflora L.

Common in tropical America. May 3 to 25 (Nos. 4194 and 4196).

Cassia atomaria L.

Common in Tropical Mexico and South America. Maria Magdalena Island, May 26 to 28 (No. 4321).

Bauhinia sp.

Apparently belonging to the genus *Bauhinia*, but very unlike any of the Mexican species with which I am familiar. A vine 6 to 9 meters long; only in fruit. May 3 to 25 (No. 4300).

Acacia sp.

This appears to be an undescribed species, of which I collected specimens on the mainland. May 3 to 25 (No. 4188).

Albizzia occidentalis Brandegee.

Probably the above species, which is found in Lower California and has been reported from western Mexico. May 3 to 25 (No. 4252).

Pithecolobium dulce Benth.

Common in tropical Mexico and South America. Often cultivated. May 3 to 25 (No. 4285).

Pithecolobium ligustrinum Klotzsch.

Common in tropical Mexico and northern South America. Maria Magdalena Island, May 26 to 28 (No. 4314).

Conocarpus erectus L.

Common throughout tropical America extending into Florida and reported from tropical Africa. May 3 to 25 (No. 4220).

Psidium sp.

Tree 6 to 9 meters high; flowers white; called 'palo prieto.' This species is not represented in the National Herbarium. May 3 to 25 (No. 4306).

Casearia corymbosa (?) H. B. K.

The Tres Marias specimens should probably be referred to this species although our herbarium material seems to represent more than one species. This form is common on the west coast of Mexico and Central America. May 3 to 25 (Nos. 4270 and 4308).

Casearia sylvestris Swartz.

Widely distributed throughout tropical Mexico, South America, and the West Indies. May 3 to 25 (No. 4241).

Casearia sp.

Maria Magdalena Island. May 26 to 28, 1897 (No. 4326).

Passiflora sp.

May 3 to 25 (No. 4249).

Opuntia sp.

May 3 to 25 (Nos. 4263 and 4286).

Gilibertia insularis Rose, sp. nov.

Tree 6 to 12 meters high; leaves 25 to 35 cm. long, including the slender petioles (7 to 18 cm. long), 9 to 20 cm. broad, entire or 3-lobed, oblong, rounded at base, rounded at apex or with a short acumination, glabrous, 3-nerved at base; fruiting inflorescence a short dense panicle;

rays 2 to 3 cm. long; pedicels 4 to 8 mm. long; fruit white, 6-lobed, 4 mm. high; styles short, connate to near the top.

Collected on Maria Madre Island May 3 to 25 (No. 4282).

Portlandia pterosperma Watson.

A species recently described by Dr. Watson, the type coming from near Guaymas, Sonora. May 3 to 25 (No. 4211).

Eupatorium sp.

May 3 to 25, 1897 (No. 4225).

Eupatorium sp.

May 3 to 25, 1897 (No. 4244).

Eupatorium collinum DC.

Common in Mexico and Central America. May 3 to 25, 1897 (No. 4199).

Mikania cordifolia Willd.

Reported from Central and South America. May 3 to 25, 1897 (No. 4299).

Conyza lyrata H. B. K.

Reported from Mexico, Central and South America. May 3 to 25 (Nos. 4290 and 4312).

Baccharis glutinosa Pers.

A common Mexican and Central American plant. May 3 to 25, 1897 (No. 4291).

Pluchea odorata Cass.

Widely distributed in Mexico and South America. May 3 to 25, 1897 (No. 4181).

Parthenium hysterophorus L.

Common in Mexico, South America, and in the southern United States. May 3 to 25, 1897 (No. 4267).

Perityle microglossa Benth.

A common Mexican plant. May 3 to 25, 1897 (No. 4266).

Porophyllum nummularium DC.

Restricted to Mexico. May 3 to 25, 1897 (No. 4292).

Trixis frutescens P. Brown.

A common Mexican and Central American plant. May 3 to 25, 1897 (Nos. 4191), and Maria Cleofa Island, May 30, 1897 (No. 4331).

Jacquinia macrocarpa Cav.

Species not represented in the National Herbarium, but reported from Mexico, and Central and South America. May 3 to 25, 1897 (No. 4208).

Gonolobus sp.

Fruit only. May 3 to 25, 1897 (No. 4313a).

Buddleia verticillata H. B. K.

A common Mexican species. May 3 to 25, 1897 (No. 4183).

Cordia sonorae Rose.

A recently described species from Sonora. May 3 to 25, 1897 (No. 4207).

Cordia insularis Greenman.

Cordia insularis Greenman, Proc. Amer. Acad. 33: 483. 1898.

The original description is as follows: "Shrub 3 to 5.5 m. high; stems and branches glabrous, reddish brown, conspicuously dotted with numerous whitish lenticels; the extreme branchlets covered with hirsute pubescence; leaves scattered, elliptic-ovate or sometimes slightly obovate, 1.5 to 3 cm. long, 1 to 1.5 cm. broad, narrowed below into a short petiole, obtuse, the upper portion more or less deeply crenate-dentate, occasionally sharply toothed, entire toward the base, hispid above, spreading hirsute-pubescent beneath, especially on the midrib and veins; inflorescence capitulate; heads small (after the corolla has fallen, about 5 mm. in diameter); peduncles, during anthesis, 1 cm. or less in length, covered with a spreading hirsute pubescence; calyx 2 mm. long, 5-dentate; teeth short, acute; corolla 3 mm. long, nearly cylindrical, with short recurved lobes, externally glabrous, pubescent inside along the line of the filaments, stamens included; style a little exserted. Collected by E. W. Nelson on Maria Madre Island of the Tres Marias group of islands. May 3 to 25, 1897 (No. 4296)."

Tournefortia candida Walp.

Not previously in herbarium. May 3 to 25, 1897 (Nos. 4217 and 4229).

Tournefortia cymosa L.

I have only seen specimens from Guatemala. May 3 to 25, 1897 (No. 4189).

Tournefortia velutina H. B. K.

Reported from the west coast of Mexico and Guatemala. May 3 to 25, 1897 (No. 4209).

Heliotropium indicum L.

Common in Mexico and most tropical countries. May 3 to 25, 1897 (No. 4253).

Heliotropium curassavicum L.

Common in Mexico and South America as well as in the Old World. Reported in the United States as far north as Oregon and Virginia. May 3 to 25, 1897 (No. 4313).

Ipomoea bona-nox L.

A common tropical plant extending into Florida. May 3 to 25, 1897 (No. 4269).

Ipomoea peduncularis Bertol.

Common in Mexico and Central America. May 3 to 25, 1897 (No. 4235).

Jacquemontia violacea Choisy.

Reported from Mexico, Central and South America, and the West Indies. May 3 to 25, 1897 (No. 4251).

Solanum nigrum L.

A widely distributed species. May 3 to 25, 1897 (No. 4200).

Solanum lanceaefolium Jacq.

A common tropical plant. May 3 to 25, 1897 (No. 4240).

Solanum callicarpaefolium Kunth & Bouché.

Common in south Mexico and northern South America. Maria Magdalena Island, May 26 to 28, 1897 (No. 4322).

Solanum torvum Swartz.

Common in Mexico and Central America. May 3 to 25, 1897 (No. 4185).

Solanum verbascifolium L.

Only reported hitherto from one station in southern Mexico. May 3 to 25, 1897 (No. 4216).

Physalis pubescens L.

A common tropical plant. May 3 to 25, 1897 (No. 4255).

Bassovia donnell-smithii Coulter.

A recently described South American and Guatemalan species. May 3 to 25, 1897 (No. 4232).

Datura discolor Bernh.

Reported from Mexico and West Indies. May 3 to 25, 1897 (No. 4197).

Nicotiana trigonophylla Dun.

Common in Mexico. May 3 to 25, 1897 (No. 4212).

Russelia sarmentosa Jacq.

A common Mexican and Central American species. (May 3 to 25, 1897 (No. 4289).

Capraria biflora L.

A widely distributed plant, extending into Florida. May 3 to 25, 1897 (No. 4195).

Bignonia aequinoctialis L. (*B. sarmentosa* Bertol.)

Recently collected at Acapulco by Dr. Edward Palmer. It is common in Central and South America. May 3 to 25, 1897 (No. 4301), and Maria Magdalena Island, May 26 to 28 (No. 4324).

Beloperone nelsoni Greenman.

Beloperone nelsoni Greenman, Proc. Amer. Acad. 33: 488. 1898.

"It is nearest *B. comosa* Nees, in DC. Prodr. 11: 416, but differs very markedly in the size of the flower and the character of the lower lip."—Greenman in litt. May 3 to 25, 1897 (No. 4246).

The original description is as follows: "Erect; stems branching, subterete, covered with a spreading or slightly reflexed grayish pubescence; leaves ovate-lanceolate or oblong-lanceolate, 5 to 10 cm. long, 2 to 4 cm. broad, obtuse at the apex, entire, narrowed below into a slender petiole, densely lineolate above, pubescent on either surface, especially on the veins, later becoming glabrous; petioles about 2 cm. in length; inflorescence terminating the stem and branches in rather close bracteate spikes; bracts oblong or obovate; bracteoles linear, nearly 1 cm. long, exceeding the calyx; calyx about 5 mm. long, deeply 5-parted; divisions nearly equal, lanceolate, acute, ciliate; corolla 2 to 2.5 cm. long; tube exceeding the limb; upper lip shortly 2-lobed, the lower more deeply 3-lobed, rather broad, somewhat plaited in the throat; capsule 10 to 12 mm. long, pubescent. Collected by E. W. Nelson on Maria Madre Island of the Tres Marias group of islands, 3–25 May, 1897 (No. 4246).

"A species closely resembling *B. comosa* Nees, but with a much shorter corolla, and broader lower lip. The leaves are also somewhat larger, longer-petioled, and much less pubescent. It may be that further material will prove this to be a variety of *B. comosa* Nees, but as the material at hand shows no sign of intergradation, it seems best for the present at least to regard Mr. Nelson's plant as a distinct species."

Lantana horrida H. B. K.

Reported from both northern and southern Mexico. May 3 to 25, 1897 (No. 4187).

Citharexylum affinis D. Don.

This is a rare Mexican species which has been "compared with the Prodromus specimen at Geneva by C. De Candolle"—J. M. G. May 3 to 25, 1897 (No. 4311).

Ægiphila pacifica Greenman.

Ægiphila pacifica Greenman, Proc. Amer. Acad. 33:485. 1898.

The original description is as follows: "Shrub 2.5 to 7 m. high; stems and branches terete, covered with a grayish brown bark and dotted here and there with lenticels, glabrous; branchlets terete, somewhat compressed at the nodes, fulvous-pubescent; leaves opposite, oblong-ovate, 5 to 15 cm. long, 3.5 to 7.5 cm. broad, more or less acuminate, entire, rounded or rather abruptly narrowed at the slightly unequal base, glabrous, or at least glabrate above, with scattered, tawny, subappressed hairs beneath, especially upon the midrib and veins; petioles less than 1 cm. in length; inflorescence terminating the stems and branches in rather close paniculate cymes; peduncles, pedicels, the subulate bracts and calyx covered by a fulvous subappressed pubescence; calyx about 4 mm. long, 4-lobed; lobes broader than long, submucronate, greenish; corolla tubular, 10 to 12 mm. long, glabrous; tube somewhat ampliated above; lobes oblong-elliptic, about 4 mm. long, obtuse; stamens equal or rarely unequal, exserted; filaments pubescent below, glabrous above; drupe yellow, obovoid, 8 to 10 mm. long, 6 to 8 mm. in diameter, one-half or more exserted from the persistent coriaceous subcrenately lobed, cup-shaped calyx.—Collected by E. W. Nelson on Maria Madre Island of the Tres Marias group of islands, 3–25 May, 1897, No. 4245 (in flower) and No. 4254 (in fruit)."

Hyptis albida H. B. K.

Several times reported from Mexico. May 3 to 25, 1897 (No. 4223).

Salvia aliena Greene.

A Mexican species. May 3 to 25, 1897 (No. 4247).

Stachys coccinea Jacq.

Common in Mexico and Central America, extending into Texas and Arizona. May 3 to 25, 1897 (No. 4265).

Iresine interrupta Benth.

Reported from western and central Mexico. May 3 to 25, 1897 (No. 4234).

Phytolacca octandra L.

May 3 to 25, 1897 (No. 4293).

Stegnosperma halimifolia Benth.

Common along the west coast of Mexico. May 3 to 25, 1897 (No. 4184).

Batis maritima L.

Extending from Florida and California to Brazil and the West Indies and also reported from the Sandwich Islands. Magdalena Island, May 26 to 28, 1897 (No. 4327).

Coccoloba leptostachya Benth.

This species has not been heretofore found in Mexico, but has been reported from Central America and South America. Maria Magdalena Island, May 26 to 28, 1897 (No. 4315).

Antigonon leptopus Hook. & Arn.

A very common vine on the west coast of Mexico. May 3 to 25, 1897 (No. 4204).

Aristolochia pardina Duch.

A little-known plant collected at Colima many years ago by Ghiesbrecht, and recently at the same place by Dr. Edward Palmer. May 3 to 25, 1897 (No. 4304).

Piper aduncum L.

Reported from Mexico, Central and South America, and the West Indies. May 3 to 25, 1897 (No. 4283).

Euphorbia sp.

May 3 to 25, 1897 (No. 4268).

Euphorbia subcaerulea tresmariae Millspaugh, var. nov.

"In the characters present in the specimens collected, this agrees well with *E. subcaerulea* Rob. and Greenm. (Pringle No. 6265, Oaxaca), except in the hairy involucre more regularly toothed involucral lobes, and in having the styles bifurcate, to the middle only, and flat-spreading with no tendency to reflexion or peltation as in the other species. The fruits may prove this to be a distinct species. May 3 to 25, 1897 (Nos. 4298 and 4202)."—Millspaugh MSS.

Euphorbia sp.

Specimens are indeterminable from lack of characters. May 3 to 25, 1897 (No. 4215).

Euphorbia nelsoni Millspaugh.

Euphorbia nelsoni Millspaugh, Bot. Gaz. 26:268. 1898.

May 3 to 25, 1897 (No. 4294, not 4284, as published).

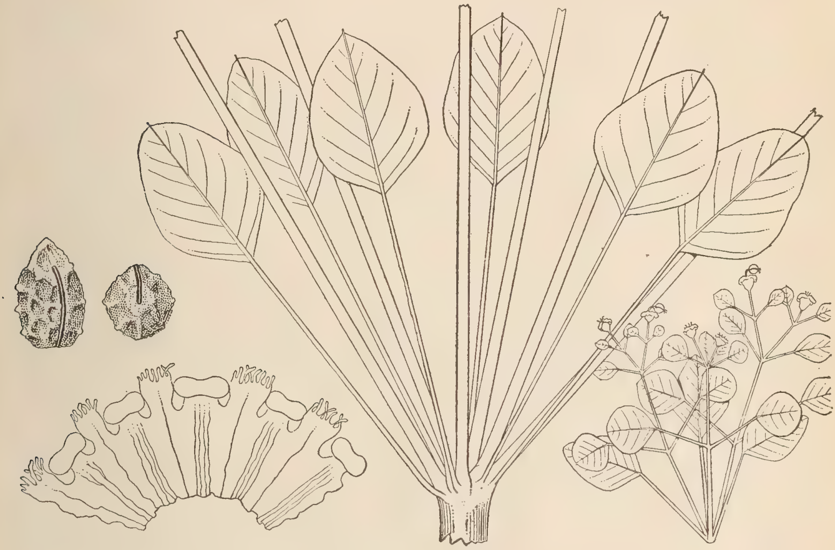


FIG. 2.—*Euphorbia nelsoni.*

The original description is as follows: "Fruticosa, glabra, longe et corymbosa ramosa, ramis teretis, internodiis longis, cortex maculatis, maculæ oblongis roseus. Foliis inferioris fasciculatis, petioliis longis filamentosis, pagina tenuis ovato-cuneatis, obtusis, apiculatis, foliis floralibus oppositis, orbiculatis petiolis limbum æquantis. Involucriis terminalibus corymbosis, pedunculatis, campanulatis glabris, lobis latis truncatis irregulariter 6–8 fimbriatis, glandulis 5, transversis oblongis integris, appendicibus minutis vel nullus. Stylis longis revoluto-circinalis. Capsulæ luridæ profunde tri-sulcatæ, semine sub-globosis pallide-fuscis, scrobiculatis, linea media nigra geminatis, rugæ anastomosantis tuberculatis 2 mm. long, 1.9 mm. lat."

Several Euphorbias were collected on the islands in too imperfect condition to determine, and it has been thought advisable to reproduce the cut[1] of the present species for the purpose of assisting future study of the flora.

---

[1] Through the kindness of the editors of the Botanical Gazette I am permitted to use this illustration.

The main figure shows a cluster of leaves. To the right is a flower cluster and to the left a dissected flower with end and side views of the seed.

Garcia nutans Rohr.

Found in Mexico and South America. May 3 to 25, 1897 (No. 4228).

Croton ciliato-glandulosus Ort.

May 3 to 25, 1897 (No. 4218).

Acalypha sp.

May 3 to 25, 1897 (No. 4260).

Celtis monoica Hemsley.

May 3 to 25, 1897 (No. 4236).

Buxus pubescens Greenman.

Buxus pubescens Greenman, Proc. Amer. Acad. 33:481. 1898.

The original description is as follows: "Shrub or small tree, 4.5 to 8 m. high; stems and branches covered with a grayish bark; the branchlets and younger shoots provided with a soft, spreading pubescence; leaves opposite or occasionally subalternate, sessile or nearly so, rhombic-ovate to oblong-ovate, 2 to 5 cm. long, 1.5 to nearly 3 cm. broad, 3-nerved, obtuse or acutish, mucronate, cuneate at the base, entire, ciliate, soft-pubescent beneath, more sparingly pubescent and glabrate above, showing the reticulate venation on the upper surface; inflorescence of axillary short-pedunculate much contracted subracemose pubescent clusters; staminate flowers pedicellate; pedicels 3 mm. long, about twice exceeding the ovate acute bracts; calyx deeply 4-parted; divisions ovate, acute, 2 mm. long, the inner divisions slightly broader than the outer ones; the rudimentary pistil somewhat quatrefoil or X-shaped; fertile flowers about 5 mm. long, single, sessile, terminating the inflorescence; ovary glabrous; fruit not seen.—Collected on Maria Madre Island by E. W. Nelson, 3–25 May, 1897, No. 4221.

"A species apparently endemic in the Tres Marias Islands, and most nearly related to the West Indian *B. pulchella* Baill."

Ficus radulina Watson.

A recent species of Dr. Watson's from northern Mexico. May 3 to 25, 1897 (No. 4261).

Ficus fasciculata Watson.

Only known from western Mexico. May 3 to 25, 1897 (No. 4288).

Ficus sp.

May 3 to 25, 1897 (No. 4182).

Myriocarpa longipes Liebm.

Found in Mexico and Central America. May 3 to 25, 1897 (No. 4275).

Agave sp.

Six meters high, leaves 9 to 18 dm. long; marginal teeth small, distant; end spine short, stout, pungent; capsules oblong, large, 7 cm. long.

This species belongs to the subgenus *Eugave* and the *Rigidae* group of Mr. Baker's revision. It is near *A. vivipara*, and perhaps not distinct. Mr. Nelson's plant does not seem to differ from specimens collected by me on the mainland. May 3 to 25, 1897 (No. 4264).

Cyperus ligularis L.

Reported from Mexico, Central and South America, and West Indies, as well as Africa and Australia. Maria Cleofa Island, May 30, 1897 (No. 4330).

Cyperus incompletus Link.

Reported from Mexico and Brazil. May 3 to 25, 1897 (No. 4259).

Panicum brevifolium L.

May 3 to 25 (No. 4257).

Eleusine indica Gaertn.

May 3 to 25, 1897 (No. 4305).

Dactyloctenium aegyptiacum Willd.

May 3 to 25, 1897 (Nos. 4295 and 4256); Maria Magdalena Island, May 26 to 28 (No. 4317).

Arundo donax L.

Maria Cleofa Island, May 30 (No. 4332).

Zamia loddigesii (?) Miq.

Reported from Mexico. Maria Cleofa Island, May 30, 1897 (No. 4329).

Pteris longifolia L.

Maria Madre Island, May 3 to 25, 1897 (No. 4201).

Aspidium trifoliatum Swartz.

Maria Madre Island, May 3 to 25, 1897 (No. 4280).

Aspidium patens Swartz.

A widely distributed species. Maria Magdalena Island, May 26 and 28, 1897 (No. 4316).

Adiantum concinnum H. B. K.

Maria Madre Island, May 3 to 25, 1897 (No. 4273).

Adiantum tenerum Swartz.

Maria Madre Island, May 3 to 25, 1897 (No. 4281).

Gymnogramme calomelanos Kaulf.

A widely distributed species. Maria Cleofa Island, May 30, 1897 (No. 4333).

PARTIAL BIBLIOGRAPHY OF THE TRES MARIAS ISLANDS.

By E. W. Nelson.

1703. Dampier, William. A New Voyage round the World, 5th ed., I, pp. 263–264. Notes the presence of seals about the Tres Marias. These notes are quoted by Allen and Alston.

1865. Baird, Spencer F. <Review of American Birds, p. 232. Description of *Granatellus francescæ.*

1866. Allen, Harrison. Notes on the *Vespertilionidæ* of Tropical America. <Proc. Acad. Nat. Sci. Phila. 1866, p. 285. Description of *Rhogeëssa parvula.*

1867. Cassin, John. A third study of the Icteridæ. <Proc. Acad. Nat. Sci. Phila. 1867, p. 48. Description of *Icterus graysoni.*

1867. Lawrence, George N. Descriptions of Six New Species of Birds of the Families *Hirundinidæ, Formicaridæ, Tyrannidæ,* and *Trochilidæ.* <Ann. Lyc. Nat. Hist., N. Y., VIII, pp. 404–405. Description of *Amazilia graysoni.*

1871. Grayson, Andrew Jackson. On the Physical Geography and Natural History of the Islands of the Tres Marias and Socorro off the Western Coast of Mexico. Edited by Geo. N. Lawrence. <Proc. Bost. Soc. Nat. Hist., XIV, pp. 261–302. In addition to Grayson's notes, Lawrence gives a few remarks on certain birds said to have been taken on the Tres Marias by Xantus and describes *Pyrrhophæna graysoni* (=*Amazilia graysoni*) and *Sterna fuliginosa crissalis* (ex Baird MSS.).

1871. Lawrence, George N. Descriptions of New Species of Birds from Mexico, Central America, and South America, with a note on *Rallus longirostris.* <Ann. Lyc. Nat. Hist. N. Y., X, pp. 1–21. Description of *Parula insularis* (=*Compsothlypis insularis*).

1874. Baird, Spencer F. <History of North American Birds, II, pp. 515, 516. Description of *Dryobates scalaris graysoni.*

1874. Lawrence, George N. Birds of Western and Northwestern Mexico. <Mem. Bost. Soc. Nat. Hist. II, pp. 265–319. Contains extracts from Grayson's notes on various species of birds of the Tres Marias.

1876. Wallace, Alfred Russell. Geographical Distribution of Animals, II, pp. 59–60. Summary of the fauna of the Tres Marias, comprising 52 species of birds, 3 mammals, and several species of snakes and lizards.

1877. Allen, Joel Asaph. <Mon. N. Am. Rodentia, 347–348. Description of *Lepus graysoni.*

1877–79. Grayson, Andrew Jackson. Historia Natural de las Islas de las Tres Marias y Socorro. <La Naturaleza IV, pp. 159, 203, and 252. A Spanish translation, by Señor Don Aniceto Moreno, of Colonel Grayson's paper originally published in the Annals of the Lyceum of Natural History, New York, X, 1871.

1878. Ridgway, Robert. Description of a New Wren from the Tres Marias Islands. <Bull. Nutt. Orn. Club, III, p. 10. *Thryothorus felix lawrencii* (= *T. lawrencii*).

1879–82. Alston, Edward R. <Biologia Centrali-Americana. Mammalia. 1879–1882. Notes on *Vesperugo parvulus* (=*Rhogeëssa parvula*), p. 21, *Lepus graysoni,* p. 177, and a seal, p. 210, on the Tres Marias.

1879–98. Salvin, Osbert, and Godman, F. DuCane. <Biologia Centrali-Americana’ Aves I and II, 1879–1898. Contains notes on various species of birds of the Tres Marias, based on the work of Grayson and Forrer.

1880. Allen, Joel Asaph. History of North American Pinnipeds, 1880, p. 290. Misc. publication No. 12, U. S. Geol. and Geog. Survey Terr. Quotation of Dampier's notes on seals about the Tres Marias.

1882. Ridgway, Robert. Description of Several New Races of American Birds. <Proc. U. S. Nat. Mus., V, p. 12, 1882. Description of *Merula flavirostris graysoni.*

1882. Stejneger, Leonhard. Description of Two New Races of *Myadestes obscurus* Lafr. <Proc. U. S. Nat. Mus., IV, p. 373, 1882. Description of *Myadestes obscurus insularis.*

1882. Thomas, Oldfield. Biologia Centrali-Americana, Mammalia, Supplement, 1882. Notes on various species of mammals found on the Tres Marias: *Vesperugo parvulus*, p. 203; *Atalapha noveboracensis*, p. 205; *Vespertilio nigricans*, p. 206; *Macrotus waterhousii*, p. 207; *Chœronycteris mexicana* [= *Glossophaga mutica*], p. 207; *Procyon cancrivorus*, p. 208; *Lepus graysoni*, p. 211.

1885. Madarász, Julius von. Ornithologiai Közlemények A Magyar Nemzeti Muzeum Gyüjteményéböl. <Természetrajzi Füzetek, IX, p. 74, Feb. 20, 1885. Description of *Vireo forreri.*

1887. Ridgway, Robert. <Manual of North American Birds, 1887. Descriptions of *Iache lawrencei* (ex Berlepsch MS.), p. 320; *Platypsaris insularis*, p. 325; *Piranga flammea*, p. 457.

1887. Ridgway, Robert. A Review of the Genus *Psittacula* of Brisson. <Proc. U. S. Nat. Museum, X, 541, 1887. Description of *Psittacula insularis.*

1891. Bryant, Walter E. Andrew Jackson Grayson. <Zoe, II, pp. 34–68, 1891. A short account of Grayson's life, with extracts from his journals on the habits of certain birds of the Tres Marias.

1898. Evermann, Barton Warren. Notes on Fishes Collected by E. W. Nelson on the Tres Marias Islands and in Sinaloa and Jalisco, Mexico. <Proc. Biol. Soc., Washington, XII, pp. 1–3, 1898. Records *Agonostomus nasutus* Günth. on Maria Magdalena and Maria Cleofa.

1898. Merriam, C. Hart. Mammals of Tres Marias Islands off Western Mexico. <Proc. Biol. Soc. Washington, XII, pp. 13–19, 1898. Descriptions of *Marmosa insularis, Oryzomys nelsoni, Peromyscus madrensis, Procyon lotor insularis, Glossophaga mutica*, with notes on other species of mammals occurring on the islands.

1898. Nelson, Edward William. Descriptions of New Birds from the Tres Marias Islands, Western Mexico. <Proc. Biol. Soc. Washington, XII, pp. 5–11, 1898. Descriptions of the following new species and subspecies: *Columba flavirostris madrensis, Leptotila capitalis, Buteo borealis fumosus, Polyborus cheriway pallidus, Trogon ambiguus goldmani, Nyctidromus albicollis insularis, Myiopagis placens minimus, Cardinalis cardinalis mariæ, Vireo hypochryseus sordidus, Melanotis cærulescens longirostris, Thryothorus lawrencii magdalenæ.*

1898. Greenman, Jesse M. Diagnoses of New and Critical Mexican Phanerogams. <Proc. Am. Acad. Arts and Sci., XXXIII, No. 25, pp. 471–489, June, 1898. <Descriptions of *Ægiphila pacifica, Beloperone nelsoni, Buxus pubescens*, and *Cordia insularis.*

1898. Millspaugh, Charles F. Notes and New Species of the Genus Euphorbia. <Botanical Gazette, XXVI, pp. 265–270, Oct., 1898. Descriptions of *Euphorbia nelsoni* and *Euphorbia subcœrulea tresmariæ.*

INDEX.

[Names of new species in black-face type.]

Abutilon reventum, 79.
Acacia, 83.
Acalypha, 90.
Actitis macularia, 34.
Adiantum tenerum, 91.
Ægialitis semipalmata, 34.
Ægiphila pacifica, 13, 78, 87–88.
Agave, 9, 12, 90–91.
Agkistrodon bilineatus, 71.
Agonostomus nasutus, 11.
Albizzia occidentalis, 83.
Amazilia cinnamomea, 45–46.
  graysoni, 12, 22, 45, 46.
Amazona finschi, 41.
  oratrix, 39–41.
Amyris, 80.
Anolis nebulosus, 65.
Anous stolidus, 26.
  stolidus ridgwayi, 26–27.
Antigonon leptopus, 88.
Arctocephalus townsendi, 18.
Ardea candidissima, 33.
  egretta, 33.
  herodias, 33.
Argemone ochroleuca, 78.
Aristolochia pardina, 88.
Arundo donax, 91.
Aspidium patens, 91.
  trifoliatum, 91.
Astragalinus psaltria mexicanus, 52.
Ateleia, 82.
Awaous, 11.
Baccharis glutinosa, 84.
Bascanion lineatum, 70.
Bassovia donnell-smithii, 86.
Bat, Big-eared, 18.
  Maximilian's Black, 15, 18.
  Mexican Red, 19.
Batis maritima, 88.
Bauhinia, 83.
Beloperone comosa, 86, 87.
  nelsoni, 13, 78, 86–87.
Bignonia æquinoctialis, 86.
  sarmentosa, 86.
Bithynis jamaicensis, 74–75.
  vollenhovenii, 75.
Boa imperator, 63, 69.
Booby, Blue-footed, 31–32.
  Brewster's, 29, 30.
  Webster's, 29.
Brachyrhampus brevirostris, 23.
  hypoleucus, 23.
Buddleia verticillata, 84.
Bursera gummifera, 80.
Buteo borealis calurus, 37.
  borealis fumosus, 12, 37–38.
  borealis montana, 37.
  borealis socorroensis, 37–38.
Buxus pubescens, 13, 78, 90.
Campephilus, 23.
Canavalia gladiata, 82.
Capparis breynia, 78.
  cynophallophora, 78.
Capraria biflora, 86.
Caracara, Tres Marias, 38–39.
Cardinalis cardinalis mariæ, 12, 22, 52.
  virginianus, 52.
  virginianus igneus, 52.
Cardinal, Tres Marias, 52.
Cardiospermum corindum, 81.
Casearia, 83.
  corymbosa, 83.
  sylvestris, 83.
Cassia, 12.
  atomaria, 82.
  biflora, 82.
  emarginata, 82.
Cathartes aura, 37.
Celtis monoica, 90.
Cereus, 12, 51.
Ceryle alcyon, 43.
Chlorostilbon insularis, 62.
  pucherani, 62.
Chœronycteris mexicana, 19.
Chordeiles actipennis texensis, 45.
Chrysotis levaillantii, 39.
Ciccaba squamulata, 39.
Circe latirostris, 46.
Cissampelos pareira, 78.
Cissolopha, 23.
  beecheyi, 50.
Cissus sicyoides, 80.
Citharexylum affinis, 87.
Cnemidophorus gularis mexicanus, 63, 68.
  mariarum, 12, 63, 67–68.
Coccoloba leptostachya, 88.
Coccyzus minor, 42.
Colubrina arborea, 80.
Columba flavirostris, 35.
  flavirostris madrensis, 12, 22, 35.
Columbigallina passerina pallescens, 37.
Compsothlypis inornata, 55.
  insularis, 11, 12, 22, 55–56.
  nigrilora, 55.
  pitiayumi, 55.
  pulchra, 55, 56.
Conocarpus erectus, 83.
Contopus richardsoni, 49.
Conurus, 23.
Conyza lyrata, 84.
Cordia insularis, 13, 78, 85.
  sonoræ, 85.
Cormorant, 32.
Corvus mexicanus, 50.
Cratæva tapia, 78.
Crocodile, 11.
Crocodylus americanus, 64.
Crotalus, 71.
Crotolaria lupulina, 81.
Croton ciliato-glandulosus, 90.
Crow, Mexican, 50.
Ctenosaura teres, 65–66.
Cuckoo, Mangrove, 42.
Cyanospiza, 23.
Cyperus incompletus, 91.
  ligularis, 91.
Dactyloctenium ægyptiacum, 91.
Datura discolor, 86.
Dendroica æstiva rubiginosa, 56.
  æstiva morcomi, 56.
  auduboni, 56.
  townsendii, 56.
Desmodium, 81.
Diplotropis diplotropis, 63, 69.
Dove, Mexican Ground, 37.
  Mourning, 36.
  Tres Marias, 36.
  White-fronted, 36.
  White-winged, 36–37.
Drymarchon corais melanurus, 70

Drymobius boddærti, 69–70.
Dryobates scalaris, 43.
  scalaris bairdi, 43.
  scalaris graysoni, 12, 22, 43–44.
  scalaris lucasanus, 43.
  scalaris sinaloensis, 43–44.
Egret, American, 33.
Elainea placens, 50.
Eleusine indica, 91.
Empidonax difficilis, 49.
Erythrina lanata, 13, 78, 81
Eupatorium, 84.
  collinum, 84.
Euphorbia, 12, 88, 89.
  nelsoni, 13, 78, 89–90.
  subcœrulea tresmariæ, 13, 78, 88–89.
Falco albigularis, 38.
  columbarius, 38.
  peregrinus anatum, 38.
  peregrinus nigriceps, 38.
  sparverius, 38.
Falcon, White-throated, 38.
Ficus fasciculata, 90.
  radulina, 90.
Florisuga mellivora, 62.
Flycatcher, Arizona Crested, 48.
  Beardless, 49.
  Golden Crowned, 50.
  Little Golden Crowned, 50.
  Olivaceous, 48–49.
  Western, 49.
Fregata aquila, 33.
Garcia nutans, 90.
Gecarcinus digueti, 73–74.
Gilibertia insularis, 13, 78, 83–84.
Glandina turris, 11.
Glossophaga mutica, 11, 18–19.
Glossophaga, Tres Marias, 18–19.
Goldfinch, Mexican, 52.
Gonolobus, 84.
Grackle, Great-tailed, 52.
Granatellus francescæ, 12, 22, 56–57.
  venustus, 57.
Grapsus grapsus, 74.
Guaiacum coulteri, 79.
Guarea, 80.
Guazuma ulmifolia, 79.
Gull, American herring, 23.
  Heermann's, 23–24.
Gymnogramme calomelanos, 91.
Hadrostomus aglaiæ affinis, 47.
Hæmatopus frazari 34–35.
  galapagensis, 34–35.
  palliatus, 34–35.
Haliplana fuliginosa crissalis, 24.
Hawk, Duck, 38.
  Pigeon, 38.
  Sparrow, 38.
  Tres Marias Red-tailed, 37, 38.
Heliotropium curassavicum, 85.
  indicum, 85.
Heron, Great Blue, 33.
  Snowy, 33.
  Yellow-crowned Night, 33, 34.
Heteropterys floribunda, 79.
Hibiscus tiliaceus, 79.
Hippocratea, 80.
Hirundo erythrogaster, 54.
Humming Bird, Grayson's, 45, 46.
  Lawrence's, 46, 47.
Hylocichla ustulata, 60.
  ustulata almæ, 60.
  ustulata swainsoni, 60.
Hypotriorchis rufigularis, 38.
Hyptis albida, 88.
Iache latirostris, 46, 47.
  lawrencei, 12, 22, 46.
Icterus graysoni, 12, 22, 50–51.
  pustulatus, 51.
Iguana, Black, 65, 66.
Ipomœa, 12.
  bona-nox, 85.
  peduncularis, 85.
Iresine interrupta, 88.
Jacquemontia violacea, 86.
Jacquinia macrocarpa, 84.
Jay, Beechey's, 50.
Kingbird, Couch's, 48.
Kingfisher, Belted, 43.
Kinosternon integrum, 64.
Lamellaxis, 11.
Lampropeltis micropholis oligozona, 70.
Lantana horrida, 87.
Larus argentatus smithsonianus, 23.
  heermanni, 23–24.
Lasiurus borealis mexicana, 15, 19.
Leptophis diplotropis, 69.
Leptotila albifrons, 36.
  capitalis, 12, 22, 36.
  fulviventris brachyptera, 36.
Lepus graysoni, 11, 16–17.
Lonchocarpus, 82.
Lovebird, Tres Marias, 41–42.
Man-o'-war bird, 33.
Marmosa insularis, 11, 15–16.
Melanerpes, 23.
Melanotis cærulescens, 59.
  cærulescens longirostris, 12, 22, 59.
  hypoleucus, 59.
Melochia tomentosa, 79.
Melopelia leucoptera, 22, 36–37.
Merula flavirostris, 60, 61.
  grayi, 62.
  graysoni, 12, 22, 60–62.
  tristis, 62.
Micropallas, 39.
Mikania cordifolia, 84.
Mimus polyglottos, 57.
Mockingbird, 57.
Momotus, 23.
Mouse, Tres Marias, 16.
Murrelet, Short-billed, 23.
Mus rattus, 16.
Myadestes obscurus, 59.
  obscurus insularis, 12, 22, 59–60.
  obscurus occidentalis, 60.
Myiarchus lawrencei olivascens, 48–49.
  mexicanus magister, 48.
Myiopagis placens, 50.
  placens minimus, 12, 22, 50.
Myiozetetes, 23.
Myotis nigricans, 15, 18.
Myriocarpa longipes, 90.
Nicotiana trigonophylla, 86.
Nighthawk, Texas, 45.
Nycticorax violaceus, 33–34.
Nyctidromus albicollis, 44.
  albicollis insularis, 12, 22, 44.
  albicollis merrilli, 44.
Oceanodroma melania, 28.
Ochna, 80.
Ocypodo, 74.
Ocypode kuhlii, 74.
  occidentalis, 74.
Opeas subula, 11.
Opossum, Tres Marias Pigmy, 11, 15–16.
Opuntia, 12, 83.
Oriole, Grayson's, 50.
Ornithion imberbe, 22, 49.
  imberbe ridgwayi, 49.
Orthalicus undatus, 11.
  undatus melanocheilus, 11.
Oryzomys nelsoni, 11, 16.
Osprey, 39.
Otopterus mexicanus, 18.
Owl, Barn, 39.
  Burrowing, 39.
Oxybelis acuminatus, 69.
Oyster-catcher, American, 34–35.
Pandion haliætus carolinensis, 39.
Panicum brevifolium, 91.
Parauque, Tres Marias, 44.
Parrot, Double yellow-head, 39–41.
Parthenium hysterophorus, 84.
Parula, insularis, 55.
  Tres Marias, 55.
Passiflora, 12, 83.
Paullinia sessiliflora, 81.
Pelecanus californicus, 32–33.
Pelican, California Brown, 32–33.
Petasophora thalassina, 62.
Perityle microglossa, 84.
Peromyscus madrensis, 11, 16.
Petrel, Black, 28.
Phæthon æthereus, 28–29.
Phalacrocorax, 32.
Phaseolus, 82.
Phocæna communis, 19.

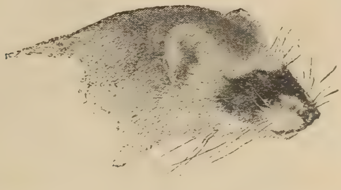
Phyllodactylus tuberculosus, 63, 64–65.
Physalis pubescens, 86.
Phytolacca octandra, 88.
Piaya, 23.
Picramnia, 80.
  ciliata, 80.
Picus scalaris graysoni, 43.
Pigeon, Tres Marias, 35.
Pilocarpus insularis, 13, 78, 80.
Piper aduncum, 88.
Pipilo, 23.
Piranga bidentata, 53, 54.
  bidentata flammea, 12, 22, 52, 53, 54.
  ludoviciana, 23, 52.
Pithecolobium, 12.
  dulce, 39, 77, 83.
  ligustrinum, 83.
Platypsaris aglaiæ, 47–48.
  aglaiæ albiventris, 47, 48.
  aglaiæ insularis, 12, 22, 47–48.
  aglaiæ sumichrasti, 47–48.
Plover, Semipalmated, 34.
Pluchea odorata, 84.
Polyborus audubonii, 38.
  audubonii insularis, 22.
  cheriway pallidus, 12, 22, 38–39.
Polygyra ventrosula, 11.
Porophyllum nummularium, 84.
Porpoise, Common, 19.
  Long-nosed, 19.
Portlandia pterosperma, 84.
Procyon lotor insularis, 11, 17.
Prodelphinus longirostris, 19.
Psidium, 35, 83.
Psittacula cyanopyga, 41–42.
  insularis, 12, 22, 41–42.
Pteris longifolia, 91.
Puffinus cuneatus, 27–28.
  knudseni, 27.
Pyrgisoma, 23.
Pyrrhophæna graysoni, 45.
Raccoon, Tres Marias, 17.
Rat, Black, 16.
  Nelson's Rice, 16.
Rhogeëssa parvula, 11, 18.
Rhogeëssa, Tres Marias, 18.
Rhynchosia minima, 82.
  precatoria, 82.
Russelia sarmentosa, 86.
Quiscalus macrourus, 52.
Saltator, 23.
Salvia aliena, 88.
Sandpiper, Spotted, 34.
Sceloporus boulengeri, 67.
  clarkii, 67.
  horridus, 67.
  oligoporus, 67.
Schœpfia schreberi, 80.
Sea Lion, 15, 17–18.
Serjania mexicana, 80.
Shearwater, Wedge-tailed, 27–28.
Solanum, 12.
  callicarpæfolium, 86.
  lanceæfolium, 86.
  nigrum, 86.
  torvum, 86.
  verbascifolium, 86.
Solitaire, Tres Marias, 59–60.
Spanish cedar, 7, 8, 9, 12.
Speotyto cunicularia hypogæa, 39.
Stachys coccinea, 88.
Stegnosperma halimifolia, 88.
Sterna elegans, 24.
  fuliginosa crissalis, 24–26.
  galericulata, 24.
  maxima, 24.
Strix pratincola, 39.
Sula bassana, 29.
  brewsteri, 29–30.
  gossi, 31, 32.
Sula nebouxii, 31–32.
  piscator, 31.
  websteri, 29.
Swallow, Barn, 54.
Tanager, Louisiana, 52.
  Tres Marias, 52, 53.
Tephrosia, 81.
Tern, Elegant, 24.
  Pacific Noddy, 26–27.
  Pacific Sooty, 24–26.
  Royal, 24.
Terñostrœmia maltbya, 13, 78.
Thalurania glaucopis, 62.
  luciæ, 62.
Thrush, Olive-backed, 60.
  Russet-backed, 60.
Thryothorus felix, 22, 57, 58.
  lawrencii, 12, 22, 57, 58.
  lawrencii magdalenæ, 12, 22, 58.
Tournefortia candida, 85.
  cymosa, 85.
  velutina, 85.
Totanus flavipes, 34.
Tres Marias, Blue Mockingbird, 59.
  Caracara, 38–39.
  Cardinal, 52.
  Chat-Warbler, 56–57.
  Cottontail, 16–17.
  Dove, 36.
  Glossophaga, 18–19.
  Lovebird, 41–42.
  Mouse, 16.
  Parauque, 44.
  Parula, 55–56.
  Pigeon, 35.
  Pigmy Opossum, 11, 15–16.
  Raccoon, 17.
  Red-tailed Hawk, 37–38.
  Rhogeëssa, 18.
  Robin, 60–61.
  Solitaire, 59–60.
  Tanager, 52.
  Vireo, 54–55.
Trichilia spondioides, 80.
Trixis frutescens, 84.
Trogon ambiguus, 42.
  ambiguus goldmani, 12, 22, 42–43.
Trogon, Goldman's, 42–43.
Tropic Bird, Red-billed, 28–29.
Turdus flavirostris, 60.
Turtle, Mud, 11.
Tyrannus melancholicus couchi, 22, 48.
Uranomitra guatemalensis, 62.
Urvillea ulmacea, 81.
Uta lateralis, 66–67.
Vireo flavoviridis forreri, 12, 21, 22, 54, 55.
  hypochryseus, 54.
  hypochryseus sordidus, 12, 22, 54–55.
Vireo, Forrer's, 54.
  Tres Marias, 54–55.
Vulture, Turkey, 37.
Warbler, Alaskan Yellow, 56.
  Audubon's, 56.
  Pileolated, 57.
  Townsend's, 56.
  Tres Marias Chat-, 56, 57.
  Western Yellow, 56.
Wilsonia pusilla pileolata, 57.
Wissadula hirsutiflora, 79.
Wood Pewee, Western, 49.
Wren, Magdalena, 58.
  Maria Madre, 57–58.
Ximenia americana, 80.
Yellow-legs, 34.
Zalophus californianus, 17–18.
Zamia loddigesii, 91.
Zanthoxylum insularis, 13, 78, 79.
  nelsoni, 13, 78, 79.
Zenaidura macroura, 36.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 10

[Actual date of publication, December 31, 1895]



Revision of the Shrews of the American Genera Blarina and Notiosorex
C. HART MERRIAM

The Long-tailed Shrews of the Eastern United States
GERRIT S. MILLER, Jr.

Synopsis of the American Shrews of the Genus Sorex
C. HART MERRIAM

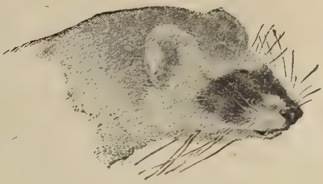
WASHINGTON
GOVERNMENT PRINTING OFFICE
1895

U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 11

[Actual date of publication June 30, 1896]



SYNOPSIS OF THE WEASELS OF NORTH AMERICA

C. HART MERRIAM

1862 1889

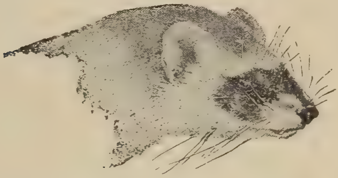
WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF ORNITHOLOGY AND MAMMALOGY

NORTH AMERICAN FAUNA

No. 12

[Actual date of publication, July 23, 1896.]



GENERA AND SUBGENERA OF VOLES AND LEMMINGS

BY

GERRIT S. MILLER, Jr.

Prepared under the direction of

Dr. C. HART MERRIAM
CHIEF OF DIVISION OF ORNITHOLOGY AND MAMMALOGY

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1896

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

NORTH AMERICAN FAUNA

No. 13

[Actual date of publication, October 16, 1897.]

REVISION OF THE NORTH AMERICAN BATS OF THE FAMILY VESPERTILIONIDÆ

BY
GERRIT S. MILLER, Jr.

Prepared under the direction of
Dr. C. HART MERRIAM
CHIEF OF DIVISION OF BIOLOGICAL SURVEY

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1897

CONTENTS OF NORTH AMERICAN FAUNA.

Number 1. **October 25, 1889.**

Revision of the North American Pocket Mice. By Dr. C. Hart Merriam. Pp. 36, pls. 4 .... Price, 10 cents

Number 2. **October 30, 1889.**

Descriptions of fourteen new species and one new genus of North American Mammals. By Dr. C. Hart Merriam. Pp. 52, pls. 8, figs. 7 .... Price, 10 cents

Number 3. **September 11, 1890.**

Results of a Biological Survey of the San Francisco Mountain Region and Desert of the Little Colorado, Arizona. Pp. 136, pls. 14 (2 colored), maps 5 (colored), figs. 2 .... Price, 25 cents

CONTENTS:

1. General Results, with special reference to the geographical and vertical distribution of species. By Dr. C. Hart Merriam.
2. Grand Cañon of the Colorado. By Dr. C. Hart Merriam.
3. Annotated List of Mammals, with descriptions of new species. By Dr. C. Hart Merriam.
4. Annotated List of Birds. By Dr. C. Hart Merriam.
5. Annotated List of Reptiles and Batrachians, with descriptions of new species. By Dr. Leonhard Stejneger.

Number 4. **October 8, 1890.**

Descriptions of twenty-six new species of North American Mammals. By Dr. C. Hart Merriam. Pp. 60, pls. 3, figs. 3 .... Price, 10 cents

Number 5. **July 30, 1891.**

Results of a Biological Reconnoissance of south-central Idaho. Pp. 132, pls. 4 (1 colored), figs. 4 .... Price, 15 cents

CONTENTS:

1. General Results. By Dr. C. Hart Merriam.
2. Annotated List of Mammals, with descriptions of new species. By Dr. C. Hart Merriam.
3. Annotated List of Birds, with description of a new Owl. By Dr. C. Hart Merriam.
4. Annotated List of Reptiles and Batrachians. By Dr. Leonhard Stejneger.

Descriptions of a new genus and two new species of North American Mammals. By Dr. C. Hart Merriam.

Number 6 (not published).

Number 7 (out of print). **May 31, 1893.**

The Death Valley Expedition: A Biological Survey of Parts of California, Nevada, Arizona, and Utah. Part II. Pp. 402, pls. 14, maps 5 (colored), figs. 2.

CONTENTS:

1. Report on Birds. By Dr. A. K. Fisher.
2. Report on Reptiles and Batrachians. By Dr. Leonhard Stejneger.
3. Report on Fishes. By Charles H. Gilbert, Ph. D.
4. Report on Insects. By C. V. Riley, Ph. D.
5. Report on Mollusks. By R. E. C. Stearns, Ph. D.
6. Report on Desert Trees and Shrubs. By Dr. C. Hart Merriam.
7. Report on Desert Cactuses and Yuccas. By Dr. C. Hart Merriam.
8. List of Localites. By T. S. Palmer.

Number 8. **January 31, 1895.**

Monographic Revision of the Pocket Gophers, Family *Geomyidæ* (exclusive of the species of Thomomys). By Dr. C. Hart Merriam. Pp. 258, pls. 20, figs. 71, maps 4 (colored) .... Price, 35 cents

Number 9 (not published).

Number 10. **December 31, 1895.**

Pp. 124, pls. 12, figs. 3 .... Price, 15 cents

CONTENTS:

Revision of the Shrews of the American Genera Blarina and Notiosorex. By Dr. C. Hart Merriam.

The Long-tailed Shrews of the Eastern United States. By Gerrit S. Miller, Jr.

Synopsis of the American Shrews of the Genus Sorex. By Dr. C. Hart Merriam.

Number 11. **June 30, 1896.**

Synopsis of the Weasels of North America. By Dr. C. Hart Merriam. Pp. 44, pls. 6, figs. 16 .... Price, 10 cents

Number 12. **July 23, 1896.**

Genera and Subgenera of Voles and Lemmings. By Gerrit S. Miller, Jr. Pp. 84, pls. 3, figs. 40 .... Price, 10 cents

All applications for Nos. 1-5, 8, and 10-12 should be addressed to the Superintendent of Documents, Union Building, Washington, D. C.

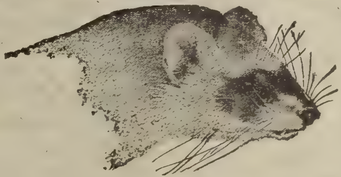
Remittances should be made by postal money order or express money order, not by private check or postage stamps.

U. S. DEPARTMENT OF AGRICULTURE
DIVISION OF BIOLOGICAL SURVEY

NORTH AMERICAN FAUNA

No. 14

[Actual date of publication, April 29, 1899]



NATURAL HISTORY OF THE TRES MARIAS ISLANDS, MEXICO

General Account of the Islands, with Reports on Mammals and Birds. By E. W. NELSON
Reptiles of the Tres Marias. By LEONHARD STEJNEGER
Notes on Crustacea of the Tres Marias. By MARY J. RATHBUN
Plants of the Tres Marias. By J. N. ROSE
Bibliography of the Tres Marias. By E. W. NELSON

Prepared under the direction of
DR. C. HART MERRIAM
CHIEF OF DIVISION OF BIOLOGICAL SURVEY

1862 1889

WASHINGTON
GOVERNMENT PRINTING OFFICE
1899

LIBRARIES SMITHSONIAN INSTITUTIO
SMITHSONIAN INSTITUTION
LIBRARIES SMITHSONIAN INSTITUTIO
SMITHSONIAN INSTITUTION
LIBRARIES SMITHSONIAN INSTITUTI
SMITHSONIAN INSTITUTION
LIBRARIES SMITHSONIAN INSTITUTI
SMITHSONIAN INSTITUTION

591.97 North American
U58 Fauna, no. 10-14
2d set 1895-99
AUTHOR Mamm.
TITLE

SMITHSONIAN INSTITUTION LIBRARIES
3 9088 00953 0130